

AN EXPERIMENT IN RELEARNING TYPEWRITING

by

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TABLE OF CONTENTS

	PAGE
CHAPTER I. GENERAL INTRODUCTION	1
CHAPTER II. REVIEW OF LITERATURE IN THE FIELD OF TYPEWRITING	3
A. History of the Typewriter	3
B. History of Keyboards	9
C. Relearning Studies	18
D. Discussion of Commercial Work	26
CHAPTER III. PURPOSE, METHOD, AND MATERIALS OF STUDY	31
A. General Purpose	31
B. Method	33
C. Materials	35
CHAPTER IV. THE EXPERIMENT	36
CHAPTER V. AN ERROR ANALYSIS	55
CHAPTER VI. COMPARISON WITH RESULTS OF OTHER "RELEARNERS"	58
CHAPTER VII. SUMMARY AND CONCLUSIONS	69
BIBLIOGRAPHY	72
APPENDIX	74

FIGURES

	PAGE
FIGURE 1. Arrangement of Keys on the "Universal" Keyboard	17
FIGURE 2. Arrangement of Keys on the New 1932 Typewriting Keyboard	17
FIGURE 3. Curves of Daily Net and Error Scores Made by Writer in One Minute Tests on New Keyboard	53
FIGURE 4. Curves of Daily Gross, Net and Error Scores Made by Writer in Five Minute Tests on New Keyboard	54
FIGURE 5. Curves of Average Gross, Net and Error Scores Made by Five "Re- learners" on New Keyboard	62
FIGURE 6. Curves of Average Gross, Net and Error Scores Made by Writer on New Keyboard	63
FIGURE 7. Curves of Average Gross, Net and Error Scores Made by Three "Re- learners" on New Keyboard	66

APPENDICES

	PAGE
APPENDIX ONE. LESSONS	74
Lesson One	74
Lesson Two	74
Lesson Two B	74
Lesson Three	75
Lesson Four	75
Lesson Five	75
Lesson Six	75
Lesson Seven	76
Lesson Eight	76
Lesson Nine	76
Lesson Ten	76
Lesson Eleven	77
Lesson Twelve	77
Lesson Thirteen	77
Lesson Fourteen	77
Lesson Fifteen	78
Lesson Sixteen	78
Lesson Seventeen	78
Lesson Eighteen	78
Lesson Nineteen	79
Alphabetic Sentences	79
Lesson Twenty	80
Lesson Twenty-One	81
APPENDIX TWO. TESTS	82
Test 1. First Typing Test Given to Students on July 1, 1932	82
Test 2. Second "New Material" Test Given, Results of Which Were Recorded for Second Week	82
Test 3. Third "New Material" Test Given, Which Was Recorded	83
Test 4. Fourth "New Material" Test Given, Results of Which Were Recorded for Fourth Week	83
Test 5. Given Students from Fifth Week on for Motivation	84
Test 6. Given Students from Fifth Week on for Motivation	84
Type of Material Used for Testing Students on New Keyboard During the Fifth, Sixth, Seventh, Eighth and Ninth Weeks of Experimental Course	85

AN EXPERIMENT IN RELEARNING TYPEWRITING

CHAPTER I. GENERAL INTRODUCTION

Due to tremendous growth within the last few years, commercial subjects have come to hold a position of importance, as judged by their election in the curricular program, second only to English. Of the various commercial subjects offered, it is generally conceded that typewriting receives the greatest amount of emphasis. Counts (1) tells us that almost a third of the time is given to the acquisition of skill in this subject.

Experience has proved that the average touch typist in beginning work, after about eighteen weeks of practice, writes from twenty to thirty-five words a minute. This apparently holds true even though different text-books are used, different methods employed, and different teachers handling the work. One major reason for this average speed rating is the fact that the typewriter, as such, has undergone very little change in the last few years. True, there have been varied technical adjustments, but not such as to bring about radical differences in the learning process. Change in the typewriter and the typewriting process has not been very noticeable since the advent of the so-called "touch" system.

1. George S. Counts. The Senior High School Curriculum, pp. 92-3

The present universal keyboard arrangement differs little from the first attempts which were made, and the first trials, as far as is known, were not scientifically devised. From time to time since the adoption of the universal keyboard, attempts have been made to better that arrangement. It is one of these revised keyboard arrangements which has made possible this study.

There have been rumors and claims to the effect that typewriting can be learned in one-half to two-thirds the time now spent on it. When one considers that there are from 500,000 to 750,000 people now training in typewriting, one appreciates the magnitude of the importance of a plan destined to save so many hours. Several studies have already been made of new arrangements which have been advocated.

The present study has been worked out, not from the standpoint of the person learning to typewrite for the first time on the universal keyboard or on one of these new keyboards, but from the point of view of the person who has already learned to typewrite on the universal keyboard and then has tested out the possibilities and practicality of relearning on another keyboard. This study, therefore, is in the nature of a psychological experiment. The new arrangement which has been adopted in this specific experiment is the "Dvorak-Dealey Simplified" keyboard.

CHAPTER II. REVIEW OF LITERATURE IN THE FIELD OF TYPEWRITING

A. HISTORY OF THE TYPEWRITER

"The advance of man from primitive savagery to its present stage of efficiency and enlightenment has been a slow process, but each stage of this process through the ages has been marked, as if by milestones, by some improvement in his means and capacity for recording his thoughts in visible and understandable form.

"The earliest attempts at word picturing by savages, the Cuneiform inscriptions of Babylonia, the hieroglyphics of Ancient Egypt, the clay tablets and stone monuments of antiquity, the papyrus of Egypt, the wax tablets and stylus of the Romans, the parchment manuscripts of the Middle Ages, the development of the art of paper manufacture, the invention of the art of printing, and even the comparatively modern invention of steel pens, are all successive stages of the evolution." (2)

Among the early efforts to make a type writing machine, we have records of the following: In January 7, 1714, the British Patent Office record indicates that a machine was made by Henry Mill, an English engineer. Mill is known as the first man to conceive the great idea.

2. Herkimer County Historical Society. The Story of the Typewriter, 1873-1923, pp. 10-11

In 1784, a machine for embossing printed characters for the blind was made. However, nothing is now known of this machine.

The first American patent was secured by William Austin Burt of Detroit in 1829. His machine was destroyed by fire at the Washington Patent Office in 1836. The Patent Office, working from a parchment copy of the original patent and other papers in the possession of the Burt family, was able to produce a replica of this machine. It was exhibited at the World's Columbian Exposition in 1893. This typewriter carried the type, not on individual bars, but on the segment of a segment, which makes it the ancestor of the present-day type wheel machine.

Xavier Projean of Marseilles received a patent for a "Typographic" machine in 1833. This machine consisted of an assembly of type bars arranged in a circle, each type striking downward upon a common center.

A further advance in the machine was made in 1843 by Charles Thurber of Worcester, Massachusetts. His contribution was that the letter spacing was effected by the longitudinal motion of a platen, a principle which is a feature of all modern machines. However, the operation of this machine was too slow, hence none were manufactured.

Machines for use for the blind were the incentive for many inventors. Pierre Foucault, a teacher in the Paris Institute for the Blind, himself blind, in 1849 presented a machine which printed embossed letters for the blind very successfully. His machines were in use for a time.

Mares points out the following: "It will be seen that the

old and the new world were running a race one with the other, in their efforts to bring this great invention to a point of perfection which would permit it to be made a commercial success. Up to the present, although portability and compactness had probably been the last things sought for, yet the machines were small, tiny, in comparison with the next one." (3)

In the fifties, the attempts at typewriter invention became more numerous. Oliver T. Eddy of Baltimore completed the Eddy machine in 1850. His machine was highly ingenious and did good work but was too cumbersome and intricate for practical use. He died in poverty after a futile appeal to the government for aid. J. B. Fairbanks and J. M. Jones of New York invented machines in 1850 and 1852, respectively.

A. Ely Beach of New York, for many years editor of the "Scientific American," in 1856 worked out a machine which marked an advance. It consisted of a series of type levers arranged in the form of a circular basket, all of which printed at a common center, much in the same manner as a modern typewriter. This machine was also made for the blind.

In 1857 Dr. Samuel W. Francis made a typewriter with keys resembling a piano. It wrote faster than a pen, but was too costly and cumbersome.

The capacity needed in a typewriter to justify its existence was its time-saving superiority. This point was not at first stressed by any of the inventors. They claimed superior legibility for the most part.

Men's thoughts did not turn seriously to machinery as a possible solution of the writing problem until the 19th century. "The invention of printing has been described as the most important single advance in the history of civilization and it seems today exactly the kind of invention which should have suggested the idea of a writing machine. But fate decreed otherwise, and more than four centuries were destined to elapse after Gutenberg had begun to use movable types before the advent of the typewriter." (4)

Christopher Latham Sholes and Glidden, printer and publisher, were largely responsible for the perfection of machines for actual manufacture. "During the interim between 1845 and 1867 numerous other writing machines were invented. That of Mr. Pratt of Alabama inspired the Scientific American to publish an article that was the direct cause of the invention of the typewriter used today. This typewriter was proclaimed 'a machine by which it is assumed that a man may print his thoughts twice as fast as he can write them and with the advantage of the legibility, compactness, and neatness of print, has lately been exhibited before the London Society of Arts--the learning of penmanship in schools will be reduced to the acquirement of the art of writing one's own signature, and playing on the literary piano...or rather on its improved successors!'"

"The article above mentioned was the inspiration for Mr. Christopher Latham Sholes, a journalist, who had held high

4. Herkimer County Historical Society. The Story of the Typewriter, pp. 11-12

positions in the commonwealth of Wisconsin, to try to invent a machine that would print serial numbers of pages in bound books. One day his friend, Mr. Glidden, said, 'Why cannot such a machine be made that will write letters and words and not figures only?' Consequently in 1867 Sholes began active work on what proved to be a practical typewriter by the year 1875." (5) James Densmore is noted for having goaded Christopher Sholes on in his inventions. To the inventor himself fell the honor of christening his own creation with the name which has always been universal among English speaking users--"typewriter". The first machines were placed in the hands of E. Remington & Sons, famous gun makers of Ilion, New York.

William K. Jenne, who is said to have developed the first commercial typewriter, was one of a group of mechanical master minds working for the Remingtons. The sewing machine influence on the machine was due to him. His machine had a foot treadle which operated the carriage return. Jenne had, for years, worked with the sewing-machine branch of the Remington business. The foot treadle quickly demonstrated its uselessness as a time saver, and was soon displaced by the now-familiar hand carriage return lever. The stand upon which the machine was placed soon followed into the discard. A metal case completely enclosed the machine. This in time gave way to the familiar open construction, but in recent years a tendency has set in to return to the enclosed feature of the first typewriter.

This original machine had many limitations, but the worst one of all was the fact that it had no shift-key mechanism. It wrote capital letters only. In this original machine we find the escapement or step-by-step "pulse beat", which causes the letter spacing. We find the type bars hung in such a manner that the type all strike the paper at a common printing point, and we find a mechanism for the return of the carriage and line spacing of the cylinder. Most interesting of all, we find the "universal" keyboard, in very nearly its present form. This was not an innovation introduced by Jenne or any of his co-workers, for, tracing back to the Sholes and Glidden model of the previous year, we find a very close approach to the same thing.

Early machines were noted for the advantages they possessed, these being legibility, rapidity, ease, convenience, economy, and time. They were made to appeal to court reporters, lawyers, editors, authors, and clergymen. It is interesting to note that business men were not included in the group specifically named for whom the typewriter was intended. Beauty was at first made one of the strong selling points. That is not given prime importance at present.

With the early machines, the cost did not breed buying interest. Early specimens of typewriting were sold as curios at the Philadelphia Centennial Exposition in 1876. There was the task of getting the machine and then getting an operator with training sufficient to operate it. The touch system was a discovery of the blind. The first school which taught typewriting was opened by D. L. Scott-Browne at New York in 1878.

B. HISTORY OF KEYBOARDS

"Who invented the 'universal' keyboard?--meaning the present arrangement of the letters on the typewriter keys. Of all the questions concerning the origin of the typewriter or any of its features, this is the one most frequently asked. The answer is that the universal keyboard, with some minor variations, has been standard since the invention of the writing machine." (6) Tracing back to the Sholes and Glidden model, we find a very close approach to the present keyboard.

"Some believe that the universal keyboard was invented by Alexander Davidson, a mechanic and surveyor of West Virginia, who was also one of the pioneers in the field of commercial education. It is known that Davidson in the later 70's, made a special study of the scientific keyboard arrangement. But there is no evidence that Davidson ever saw a typewriter before the year 1875, at which time the keyboard had already assumed the 'universal' form.

"It is positively known that Densmore and Sholes, laboring together, worked out the universal arrangement of the letter keys. Just how they happened to arrive at the arrangement, however, is a point on which there has always been much speculation. It must be remembered that both of these men were printers by trade, a most important point in this connection.

6. Herkimer County Historical Society. The Story of the Typewriter, p. 66

The usual a b c arrangement of letters, which would naturally suggest itself to the ordinary lay man means nothing to a printer who is more familiar with the arrangement of the type in the printer's case. Here, however, we encounter the fact that the arrangement of the letters on the universal keyboard is nothing like the arrangement of the type in the printer's case. The truth seems to be that the arrangement of the universal keyboard was mainly influenced by the mechanical difficulties under which Sholes labored. The tendency of the type pairs on all the Sholes models was to collide and 'stick fast' at the printing point and it would have been natural for Sholes to resort to any arrangement of the letters which would tend to diminish this trouble. These mechanical difficulties are now of the past but time has proved and tested the universal keyboard and has fully demonstrated its efficiency for all practical needs.

"Keyboard reform has been agitated more than once since the invention of the typewriter, but such movements have always come to nothing--for a very simple reason. It is an easy and simple matter for the manufacturers to supply any keyboard the user may require; indeed, the special keyboards now in use number thousands. But to induce typists generally to unlearn the universal keyboard and learn another would be a well-nigh impossible task. And it would not pay them to do so, for no 'reformed' keyboard could ever confer a profit sufficient to offset the time loss such a change would involve. The universal keyboard has a hold similar to that of language itself." This viewpoint has yet to be proved false. The present experiment

shows the effect of relearning upon the person who can already typewrite on the universal keyboard. The quotation just made was that of the Herkimer Historical Society. (7)

"When the machine is in normal position, the depression of any of these keys will cause the lower case letter corresponding thereto to print. In order to obtain the capital or upper case letter, it is necessary, first of all, to depress what is called the shift-key, viz., that on the lower left hand corner of the machine, and when this is done, the carriage is moved forward, and the key, being depressed, imprints the capital letter. Thus a double movement is necessary in order to produce what, after all, is but a primary result." (8)

"In order to obviate this necessity, a number of machines have been devised, wherein the keyboard is so extended as to provide a separate key for every character carried by the instrument. The first of such machines was the Caligraph, of which a full account will appear hereafter. In this instrument a very peculiar system was adopted. The keys slightly differed in their arrangement from those on the Remington, and the lower case letters were grouped in the centre of the manual, the upper case and figure keys surrounding them like a protecting halo.

"This lack of uniformity of arrangement jarred on the nerves of many people, since it involved the memorising of the position of every single key, so that when the Bar-Lock was

7. Ibid., pp. 66-68

8. Geo. Carl Mares. The History of the Typewriter, p. 48

placed upon the market, a double series of keys was provided, every one of the upper case being in exactly the same position as those in the lower case arrangement. Thus, although the Caligraph was the first machine with a complete keyboard, the Bar-Lock was the first with a double arrangement. The simplicity thus afforded is apparent, when it is remembered that, in order to strike an upper case letter, the position of the hands is not varied, all that is required being to lift the hands bodily up to the upper bank of keys.

"But with many persons, the shift key did not seem to be a source of trouble. They considered the idea good, and that the only weakness about it was that it was not carried far enough. An arrangement was therefore made providing for a double shift key: the printing being of the lower case letters when the machine was normal, upper case letters being obtained by the depression of the upper case shift key, and figures and signs by the depression of the figure key.

"The Williams Typewriter Co., in their earlier models, provided, as we shall see, for this double shift arrangement, and in their literature of those days brought forward the following argument in favour of it. The keyboard they had was as follows: '...If half the number of keys on the Remington keyboard could be dispensed with by the addition of another mechanical stroke occasionally, the mind would push the fingers to greater speed than any yet attained. But a change which burdens the mind to relieve the fingers is a change toward slowness and not toward speed.'

"In changing over to the single shift arrangement in the

No. 4 model, the Williams people treated this matter very cavalierly. They stated: 'It is useless to discuss the merits of the various kinds of key-boards and shift-keys. It is sufficient that the universal key-board with one shift for capitals is approved by the great army of typewriter operators. The Williams No. 4 meets and satisfies the popular demand in its keyboard as in all other respects.'

"It would seem that given an average all round class of general work, the use of the shift key machines is to be preferred: but where figures and capitals follow in frequent succession, as in accounts and tabular work generally, then very much is to be said in favour of the double keyboard arrangement.

"Compactness of keyboard is a positive essential if typewriting is to be executed at the highest speeds." (9)

One Mr. William A. Gilbert of ^{E. 260 912} Spokane, Washington, has worked on a so-called "Orthographic Keyboard," a proposed improvement of the present typewriter keyboard based upon the principles of the English language which it is intended to transcribe--consisting of the interchanging of certain letters and characters upon said board, giving the reasons therefore, and results therefrom, expecting to obtain a superior keyboard as an instrument for writing the English language, together with reasons for utility.

Gilbert says of this keyboard, "Let it be understood that this keyboard is for future generations of typists and

stenographers; that there is plenty of work for the present. But if this keyboard does what is claimed for it, and when the new typist is trained by an equivalent amount of practice, the older machines and the older generations will gradually go out of use. They cannot compete; they cannot hold their own on even terms with this new system.

"The older system will fail for two very good and sufficient reasons; it is not coordinated for the language that it writes; it is not adapted to the hands that play upon it. While the one is adapted to safe motion, those who play on the 'standard' will be playing a game of hop, skip, and jump all over the keyboard to finish their spelling lesson.

"We found in our language certain constant relations among the letters, herein called iteratives, which can be presented upon the typewriter keyboard 'in conjunction'. Upon the standard keyboard they are presented in 'opposition'. Some of them are as far apart as possible. So that if this new keyboard will work, you are through with the standard." (10)

Typewriting changes now seem very difficult to bring about although such changes are bound to occur. Mares states: "But although, so far as the broad lines of the machine are concerned, we are not likely, just at present, to see any radical changes, he would be an exceedingly rash prophet who would declare that typewriter skill had reached its limit. The gradual concentration of ideas upon a converging theory must tend to lead to

10. William A. Gilbert. The Orthographic Keyboard, pp. 76 ff.

considerable advances in matters of detail subservient thereto--- The use of a universal ribbon so far as widths is concerned, now stands in marked contrast to the dozen widths used but very few years ago. The principal of visible writing has now been adopted almost universally, as well as the introduction of a bi-chrome ribbon. Every machine calling itself 'standard' is now fitted with a built-in tabulator as part of the machine, without additional cost, whereas say four or five years ago, this device would cost anything from two to five pounds additional; and the back space key, which is without doubt, the most useful adjunct ever supplied to a typewriter, is found even on the lower priced instruments.

"Developments may therefore be looked for along the line of new devices and adaptations of the writing machine to purposes at this time not thought of...And various additional conveniences will necessarily be added in order to render the machines more and more suitable to these extended applications. Probably, we do not know, but probably an automatic carriage return may be one of the first improvements. A machine capable of using two styles of type, such as roman and italic, in conjunction with a compound shift key arrangement, might appeal to many people..."

(11)

After six years of work revising the typewriter keyboard, Dr. August Dvorak of the University of Washington has presented a new keyboard arrangement which he claims will successfully

supplant the former one. Dr. Dvorak studied 36,000,000 two-letter combinations and 23,000,000 three-letter combinations. He discovered that there were 10,500,000 awkward combinations on the standard keyboard. His keyboard, he says, has reduced the number of bad combinations to 1,500,000. He has concentrated the letters which are used most frequently on the second line from the bottom--so that 70 per cent of all words are written without reaching up or down. The letters on this line are A, O, E, U, I, D, H, T, N, and S. All the vowels are on the left side--which makes it impossible to write any word with the right hand alone. Only about fifteen words can be written with the left hand alone.

Under the present system 59 per cent of the work on a typewriter is written with the left hand--which also has to shift the carriage--although the right hand is more efficient. Under Dvorak's plan, the right hand does fifty-five per cent of the work. A copy of the universal and the revised keyboards are to be found on page seventeen.

Tests show that students can write fifty words a minute after fifty hours of practice on it, or double that on the present standard keyboard.

Forty new keyboard typewriters have been supplied Dr. Dvorak by the Typewriter Education Research Bureau of New York City for experimental tests.

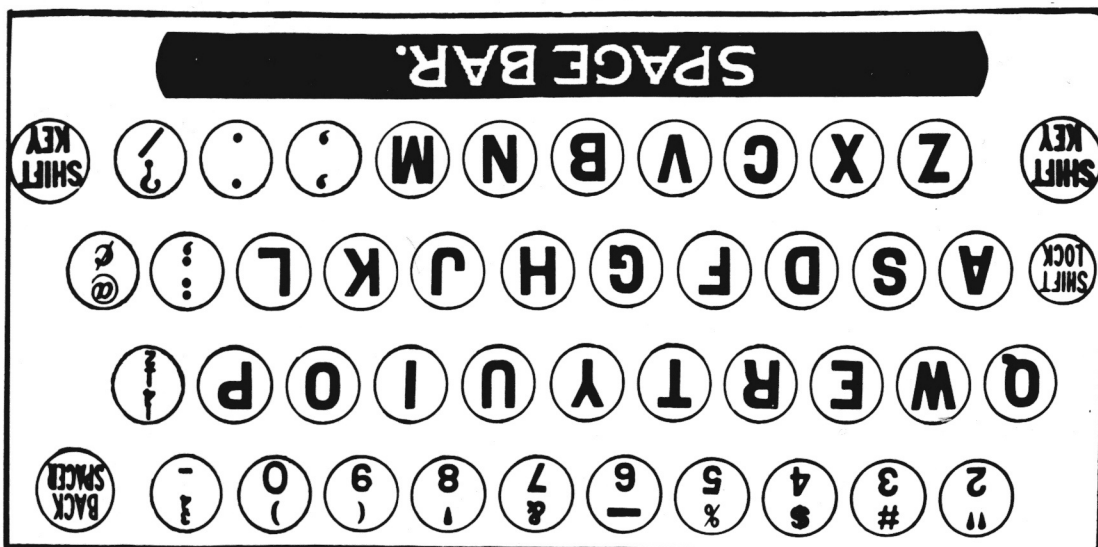


Figure 1. Arrangement of keys on the "universal" typewriting keyboard.

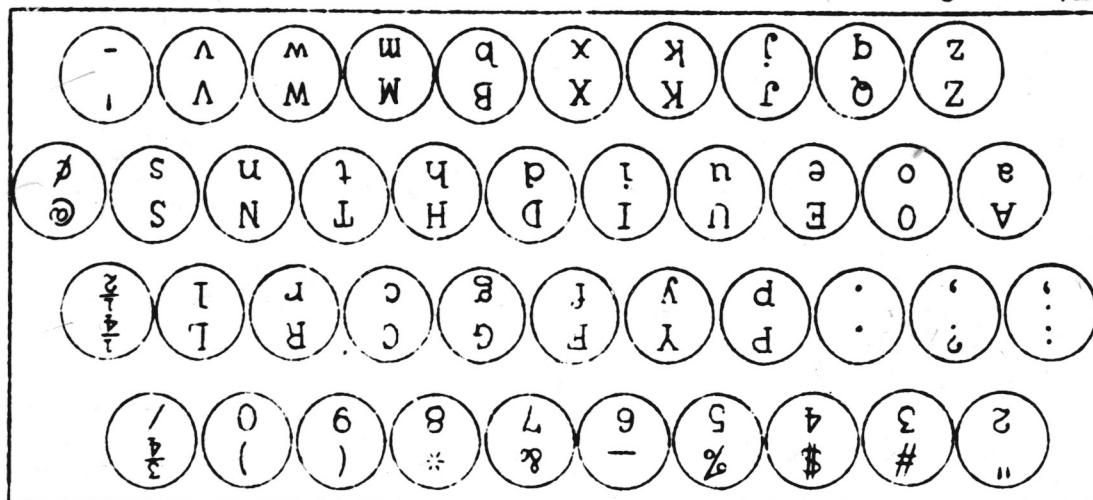


Figure 2. Arrangement of keys on the new 1932 typewriting keyboard.

C. RELEARNING STUDIES

One of the first problems which arise in connection with relearning is the problem of transfer of training. The old theory to the effect that reasoning ability developed in one course is carried over into some entirely different field, has gradually been supplanted by a more recent outlook, namely, that the learning of one mental function may facilitate the learning of another wherein they possess identical elements.

A. I. Gates in his "Psychology for Students of Education" (12) has advocated the second outlook on the problem. Thorndike (13) in his "Principles of Teaching" also stresses the fact that there is a transfer where identical elements are involved. Bolton (14) has brought out this same viewpoint. These are just a few of the modern writers who have dealt with this question.

The fact that there is a transfer of training, then, is one step which will vitally affect all studies in relearning, and the extent to which there are identical elements in each study will be a large factor in determining the results of experiments, whatever the nature.

In her thesis, Miss Ferree (15) points out that transfer

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12. A. I. Gates. Psychology for Students of Education, pp. 435-436
 13. E. L. Thorndike. The Principles of Teaching, pp. 243-4
 14. F. E. Bolton. Principles of Education, p. 748
 15. Edna Mae Ferree. An Evaluation of the Present Status of Transfer of Training from an Experimental Standpoint, Master's Thesis, University of Washington, pp. 216-218

actually takes place, that its effect may be positive, zero, or negative. It is usually positive, but the amounts are almost always nearer to zero than to one hundred per cent. For transfer to take place, the second situation must be somewhat different and yet somewhat the same as the first. This difference and similarity should not only be quantitative but also qualitative. Transfer involves flexibility, modifiability, and enrichment of experience. She says that the factors which further the process of transfer are: (a) an alert, native intelligence; (b) an organization of subject matter in a logical manner so that principles or generalizations may result; (c) efficient methods of instruction employed by the teacher.

Bergstrom (16) discusses a problem which Dr. Munsterberg stated, namely, "Can a given association function automatically while some effect of a previous and different association with the same stimulus remains?" He concluded that it can, and that nerve currents do not divide like electric currents along different lines of association, inversely as the resistance, but that a slight difference, one way or another, diverts the whole discharge in that direction. The experiments were made with some of the common habits of daily life, such as the opening of the door of his room, dipping his pen in ink, and taking his watch out of his pocket.

McMein and Washburn (17) found that there was least inter-

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16. J. A. Bergstrom. The Relation of the Interference to the Practice Effect of an Association, American Journal of Psychology, Vol. 6, No. 55, p. 433
 17. M. McMein and M. P. Washburn. Effect of Mental Type on the Interference of Motor Habits, American Journal of Psychology, Vol. 20, 1909, pp. 282-4

ference in the case of the most complex habits.

The effect of training upon the formation of new habits may be positive or negative; that is, the formation of the stimulus response coordination may be facilitated by training which has preceded it.

Hunter, Yarbrough, and Pearce (18) in an experiment with white rats have shown that habits established in the rat may interfere greatly with the acquisition of further habits. The experiment consisted of training rats in a "t" shaped box to go to the right side when light was presented and to the left for darkness. An average of 286 trials were necessary to master this habit. When it was mastered the rats were trained to go in the opposite directions for light and darkness. An average of 603 trials were required to master the second habit. Interference appeared when graphed to be in the first one-half of the learning process.

That which transfers sometimes increases and at other times decreases efficiency in the new situation. This has been proven in the playing of different games, tennis and handball, for example. The stroke used for both games is very different. Yet, there are possibilities for transfer in remembering to keep one's eyes on the ball, etc. This example is suggested by Gates (19) in his "Psychology for Students of Education".

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18. Walter S. Hunter. Habit Interference in the White Rat and in Human Subjects, Journal of Comparative Psychology, Vol. 2, 1922, pp. 29-59
19. A. I. Gates. Psychology for Students of Education, p. 429

In 1893, Muller and Schumann (20) published reports which indicate that if idea A has been associated with idea B, it is more difficult to associate A with C than if the first association had not been made.

Attention and fatigue play an important part in any relearning study. It is found that when a person is in a stage of fatigue, he has much greater difficulty in giving attention. Tolman (21), in a study of retroactive inhibition, found that pleasant lists which were learned when a person is stimulated, in an efficient hour of the day, all seemed to require fewer repetitions for the same amounts of learning than indifferent lists learned without caffeine and lists learned in an inefficient hour of the day. He proposes, then, in terms of the writer's relearning experiment, that for the best and quickest results an efficient hour of the day should be utilized. The elements of attention and interest add materially to the possibilities of learning. Hepner (22) points out that the subjective feeling of displeasure in fatigue is not a reliable measure for the objective fatigue, that is, for the real reduction of the ability for work. Daily experience teaches us how some people go on working until they have a nervous breakdown because nature did not protect them by the timely appearance

20. Charles H. Griffitts. Fundamentals of Vocational Psychology, p. 191

21. E. C. Tolman. Retroactive Inhibition as Affected by Conditions of Learning, Psychological Monographs, Vol. 25, # 1

22. Harry W. Hepner. Psychology in Modern Business, pp. 206-220

of strong fatigue feelings. Others feel fatigue right away because they did not learn early to inhibit the superficial feelings of fatigue. There are, then, many individual differences in fatigue which must be allowed for. An incident was called to the author's attention in which the effect of stimulation was markedly demonstrated. A boy who had just been in an automobile wreck was instructed to take a typewriting test immediately afterward. He surpassed all his former records by quite a margin.

Many of the so-called laws of learning apply as well to relearning. When the relearner is in readiness to do something, to do so is satisfying. The more often a connection is made between a situation and a response, the greater should be that connection's strength. When the effect is such that it is satisfying, the strength of the connection is increased.

Similarly, we find that mind set or attitude can do very, very much to aid in a relearning experiment. This has been repeatedly demonstrated. The law of assimilation or analogy has already been suggested in connection with the discussion on transfer of training.

There are three stages in habit formation according to Schnackel: (23)

(a) There is a learning period during which the reaction that is to be made habitual is performed with conscious super-

vision at every point. This is followed by

(b) A practice period during which the conscious supervision is exercised only at those points where the learning has not been complete, and care must be exercised to guide the activity in the proper direction. During this period the need for constant supervision gradually diminishes until the stage is reached where

(c) Conscious supervision is no longer needed. The presentation of the appropriate stimulus evokes the correct response automatically. These same periods are found in cases of relearning.

Schnackel goes on to state: "The greatest difficulty in habit formation is encountered when the habit to be formed is to replace another habit. This is usually termed breaking a habit and is literally such, since a set of performed and permeable synaptic connections must have their permeability broken down and replaced with resistance. Attempts at gaining this result directly are foredoomed to failure. Direct inhibition of a reaction may be effective so long as the reaction is conscious, but direct inhibition will never eradicate an established habit. Persons who had once learned to swim and afterward made no use of the habit for years have responded to sudden immersion in deep water with appropriate swimming movements even in cases where conscious recall of how these had been used in swimming was impossible....Substitution in breaking of habits: The only way of insuring that a given stimulus will not result in an undesirable reaction is to associate it with a desirable reaction. For such a substitute association the period of

conscious reaction to stimulus will necessarily be much longer than in usual cases of mastering new habits since the slightest lapse of attention at a critical point in the process may undo the results of many correct performances. The reaction to be replaced must be considered in the same light as extraneous movements in the mastering of a new coordinate and excluded from the focus of attention by concentration upon the reaction that is to replace it. Much closer attention must be given to the attainment of correct practice in this case since every performance calls for the selection of one of two possible reactions instead of one of a larger number.

"If several incorrect associations are possible the chances of any one of them becoming very firmly fixed are reduced in proportion to their number. When there are only two possible incorrect associations, the correct one has a two to one chance of becoming the one which is finally established, but with only one possible incorrect reaction each lapse of attention and consequent incorrect reaction is expended only on one incorrect association. In the elimination by substitution, additional vigilance is required because the habit to be eliminated is already established as a non-conscious reaction so that it is possible for a reaction to occur before the individual is aware that a stimulus has been presented." (24)

Robinson (25), in another study, brings out the fact that

24. Ibid., pp. 64-5

25. E. S. Robinson. Some Factors Determining the Degree of Retroactive Inhibition, Psychological Review Monograph Supplement, 1920, Vol. 28, No. 128, p. 57

learning after a rest period is recalled more easily than learning after a work period. Where the in-between period is a work period, there is much more fatigue before the last learning period. He also states that the similarity of the work which is interpolated between the time of the original learning and the learning which follows the interpolated period has a marked effect on that which is learned last. The time factor, too, is very important in judging the final learning and the extent to which inhibition occurs.

Webb (26), in a study of the transfer of training and retroaction, points out that there is more individual variability in relearning a maze than in the original learning. He states that there is no correlation between the learning and relearning records. Humans were discovered to have a greater retentive capacity than rats.

26. L. W. Webb. Transfer of Training and Retroaction, Psychological Review Monograph Supplement, Vol. 24, No. 3, 1917, pp. 1-90

D. DISCUSSION OF COMMERCIAL WORK

The growing recognition of the need for commercial education has been considered to a greater and greater extent by educators of prominence. Judd treats the matter as follows:

"It is interesting to note that the masses, so far as they can express themselves, are asking for a change in the traditional curriculum and are likely to get it. The masses are expressing their demands through the courses sought by their children.....

"High schools in all parts of the country are giving commercial courses in increasing degree. The first type of industrial education to be extensively cultivated in the United States was commercial education. This consisted in training for clerical positions and was carried on for the most part in private 'business colleges'.....

"The high schools of the country entered into competition with the private commercial schools, and for some years the competition has been running high. The private schools solicit and get a large patronage on the ground that they do not teach anything that is useless. They give short, compact courses fitted to pupils' needs. The high schools point out that the short courses leave the stenographer with a meager vocabulary and the clerk with no outlook on life.

"The public schools are gradually pulling ahead of their competitors because they are employing a higher grade of teachers than formerly and are doing the work in a fashion which is technically more complete. In the meantime the commercial courses

are becoming more 'respectable' and are being taken by a better grade of students. The effect of the election of commercial courses by a better grade of student is such as to modify the whole program of the school in the direction of more attention to the needs and practices of business life." (27)

For a long time after the demand for business education was felt, the public was content to see the school neglect vocational training. Private institutions, such as business colleges, sprang up as agencies for satisfying the demand for this specialized training. These were tuition schools and secured their students in many cases by criticizing public schools as incompetent and wasteful. In some cases, employers realized the need for this special training and had it carried on within their businesses. In other cases, men were trained by blundering along at low wages until the trade was learned. Even today the private training of young people for industry is conducted on a scale that shows how new is the idea that the public school is responsible in any degree for such training.

Many object that there is a tendency to spend too much time on specialized training. This objection can be partially eradicated by the use of the new typing keyboard which cuts down on the amount of time required in learning to typewrite. This would do away with much time spent on routine and automatic training. More time might then be spent on cultural needs and appreciation.

Mr. M. L. Pearson of the Pasadena Junior College, President of the Southern California Commercial Teachers' Association, in a bulletin entitled "Symposium on Commercial Education," writes: "Business education, with its high ideals, is developing a sense of its own importance. It no longer apologizes for the content of its curriculum nor the training of its teachers. The number of years of professional and technical training of business teachers has rapidly increased. The schools of education of our universities are providing more and better courses for training our members. School administrators are giving up the idea that business teachers are merely 'checkers' and laboratory directors and hence can teach an extra subject. The dumping of inferior students into the department of business education is gradually ceasing. We have succeeded in breaking down many of the prejudices against business education.

"Business teachers are proud of the progress which has been made in the past few years. No less a person than our beloved teacher-philosopher, Dr. John Dewey, states that the most significant development in teaching in recent years has been in the field of business education.

"However, we cannot rest contented with our past laurels. In a rapidly changing economic world we must forever be on the alert. Business education assumes the responsibility of preparing young people to take their places in the complicated and ever-changing business world. It must not only prepare them to pass the acid test of the business world of today, but

it must also prepare them to meet the changing conditions of tomorrow. The department of business education must not only give its students the finest technical training; it must also prepare them to meet the changing conditions of tomorrow. The department of business education must not only give its students the finest technical training; it must also give them an understanding of the basic principles of economics which will enable them to master the new conditions. It must also prepare our young people to become good citizens of our democracy."

Mr. Shields, in an article pointing out what business expects of commercial education, says: "When the private business school first offered its services to the public, American business methods were comparatively simple. Industry was in that stage of development when conditions did not require conservation of natural resources nor the use of complicated standards and procedures. Production was yet to experience the meaning of 'large-scale production'. The industrial unit was small. The number of employees in any one establishment was also much less when compared with modern enterprises. The division of labor was much less developed than found today in the larger concerns. The corporate form of organization was not employed extensively. There was less domination in banking and finance. Methods and procedures in business were not uniform and highly systematized. The relationships of owners and managers, and workers were personal. The plan of industrial organization was simple. Marketing problems were not complicated, and there was a seller's market with little or no need of marketing analysis. Such were the characteristics of American industry as late as

the seventies of the past century.

"With the introduction of commercial subjects in our public schools during the nineties there were evidences of the rapid development of large scale industry. During this decade, however, the entrepreneur was beginning to realize that he confronted a number of serious problems. The cost of labor and raw materials was increasing. There were serious marketing problems.

"Within a few years after the public schools became interested in commercial education, several institutions of higher learning introduced courses in commerce. It has been only during the past two decades, however, that the universities have contributed to this movement, which was but the logical outcome of a scientific age....." (28)

28. John Shields. What Business Expects of Commercial Education, The American Shorthand Teacher, Vol. X, No. 8, April 1930, pp. 279 ff.

CHAPTER III. PURPOSE, METHOD, AND MATERIALS

A. GENERAL PURPOSE

The purpose of this experiment was to investigate the various problems involved in relearning typewriting. There have been many studies involving the relearning of the same keyboard after a period of time has elapsed since the original learning. This study is unique in that it entails learning a new and different keyboard after having already achieved skill on the "universal" keyboard.

Some of the various phases included in the purpose of this thesis are: (1) to show to what extent such relearning may be carried on; (2) to indicate the acquisition of speed as compared with the original learning to typewrite; (3) to investigate the possibilities of typewriting using two keyboards alternately; (4) to show the effect of concentrating only on the new keyboard; (5) to study the error aspect of relearning as compared with the original learning; (6) to demonstrate in what respects there is a transfer of training from one keyboard to another; (7) to discover similarities between problems involved in relearning and the original learning; and (8) to point out how records of others correspond with this study. Incidentally, such considerations as the effect of attention, interest, fatigue, and satisfaction in relearning will be dealt with in showing how they affect relearning.

The extent to which the typewriting on one machine interferes with the typewriting on another which has a different keyboard will be indicated, since the writer has actually tried out the problem of teaching the "universal" keyboard after having spent a period of time on the revised keyboard only. The writer, since the experiment, has returned to the use of the standard keyboard.

B. METHOD

This experiment was conducted during the 1932 summer session at the University of Washington. The writer attended the class which met at nine o'clock five days a week. The class period was for fifty minutes each morning.

All students were grouped together, whether beginners or relearners, whether junior high school pupils, college students, or adults. There were no regular machine assignments, the students taking any typewriter available at the time they entered the room. There was a natural tendency, however, for those who came first to take the same machines from day to day.

Before the relearning experiment began, the writer took two fifteen minute tests on the standard keyboard, Underwood test material being used.

The first day students were asked to make patterns of the keyboard. The patterns indicated the fingers to be used on the different keys. These patterns were to be memorized. The touch method was used. Inasmuch as the writer entered the class a week after it had begun, she did not get the preliminary instructions with respect to the work on the keyboard.

After a bit of practice on exercises, a test was given, and thereafter tests were given every week on new material. One minute tests were given daily on familiar material for motivation. Five or ten minute tests were given almost daily, often on familiar material. The tests were scored according to the international contest rules by the instructor in charge, and daily records of all pupils were also kept. Everything

typed was turned in to the instructor.

The first few weeks of the experiment, the writer used both the "universal" keyboard and the "Dvorak-Dealey Simplified" keyboard, the former being used at home in the writing of term papers, etc., and the latter being used for school practice. For the last two weeks of the experiment the writer used only the revised keyboard, both at school in class work and at home in the writing of necessary papers. It should be understood, then, that the time spent on class work was not the only time spent on relearning.

Introspective comments were recorded from time to time as the relearning progressed.

The records of the other relearners were referred to in comparing results with those of the writer.

The reading material in the form of mimeographed exercises was prepared by Miss Vicks Oetting, the instructor. Special pages within the material to adapt the material to the new keyboard. The word list of 1,500 most commonly used words was used.

Original charts were used which appear in the appendix.

Charts were written which also appear in the appendix.

Other testing material prepared by the American typewriter companies was also used. This was the material which is occasionally used in class room work in the high schools.

The records of other relearners were made available to the writer through the courtesy of the instructor. These relearners also supplied information requested of them.

C. MATERIALS

Underwood Standard typewriters were used in this experiment. They were rebuilt machines furnished by the University Book Store and the University Mimeograph Company. The keys were removed from the old positions and bent to fit in new locations. The touch was impeded by this fact. Pupils took any available machine upon entering the room, hence allowance should be made for variations thus resulting.

There was no individual table for each machine, consequently there was no allowance for varying heights and sizes of pupils. In many cases, especially vigorous carriage returns on the part of one pupil caused vibrations and annoyance to all others at the same table. The tables were temporary constructions and the chairs ordinary ones.

The teaching materials in the form of mimeographed exercises were prepared by Miss Viola Goehring, the instructor. Special preparation was necessary to adapt the material to the new keyboard. The Ayer List of 1,000 most commonly used words was used. Five original tests were used which appear in the appendix. Lesson sheets were written which also appear in the appendix. Other testing material prepared by the various typewriter companies was also used. This was the material which is customarily used in class room work in the high schools.

The records of other relearners were made available to the writer through the courtesy of the instructor. These relearners also supplied information requested of them.

CHAPTER IV. THE EXPERIMENT

On the last day of June, 1932, the writer was given two speed tests of fifteen minute duration, the first one on Underwood test material and the second one on Remington test material. The speed rating in the first test was sixty-three words a minute with thirteen errors. The second test rating was sixty-three words a minute with nine errors. These tests were written on an Underwood typewriter with the standard keyboard.

The writer's specific training in typewriting was secured through one year of high school typewriting in the year 1925-26. Thus, six years of time had elapsed for the development of speed on the standard keyboard. The writer's maximum speed on the standard keyboard at the end of that first year of typewriting was forty-eight words per minute net, with five errors. This was based on a ten minute test. The speed which was acquired since the first year of typewriting came, not as the result of systematic practice, but rather, incidentally, in the preparation of college class room assignments and later, in connection with the teaching of typewriting for a two-year period. Yet, the teaching was not greatly conducive to the writer's development of speed. The maximum speed ever achieved was seventy-eight net words a minute with two errors in a ten minute test.

The writer began the problem of relearning with a well-developed interest in the subject. There was, perhaps, some curiosity as to whether the former typewriting habits would be

effaced or supplanted and, no doubt, a definite desire to refrain from losing the old skill, but the writer did not propose to let this stand in the way of success in the learning of the new keyboard. There was, too, the added desire to excel in a class composed of so mixed a group.

On the last day of June, 1932, the writer was given a pattern of the new keyboard and instructed to learn it by the next class period the following morning at 9:00 o'clock. This was accomplished with little difficulty inasmuch as the writer was already cognizant of the physical layout of the keyboard, the fingers to be used for striking certain keys, and the location of the shift key and the space bar. The writer was aided in this memorization by placing the fingers on the keys of a standard keyboard machine and thinking the new letters.

On the first day of July the writer attended her first regular class meeting. Upon this day the first material presented for practice work was the first lesson, which is to be found in the appendix. It will be observed that this exercise is for strengthening the little fingers, the weak ones which are least commonly used. After practice on this exercise for perhaps ten minutes, the writer participated in a class test of five minute duration. It will be recalled that the rest of the class had already had two weeks of instruction.

The writer's reaction to the test was such as the ordinary beginner experiences after three weeks or so of practice. The speed was fifteen gross words a minute. However, there were four errors, hence the net was brought down to seven words per minute. This was the result of a few minutes of practice. The

progress was necessarily slow, but the writer experienced a certain exhilaration in locating keys to strike which were not according to the customary response. The first test material was very simple. It will be found in the appendix under Test One.

The writer was instructed not to spend too much time on the preliminary meaningless exercises, but rather, to proceed to the meaningful word material, for the reason that the purpose of the first exercises, namely the development of strength in the weaker fingers, had already been accomplished from former typewriting. Certain words, the very simple ones which are repeatedly used, were quickly written without hesitation. On July the sixth, a ten minute test was given, the first to be given to the class. In this test, after two days of practice, the writer made a gross speed of twenty-nine words a minute. Reference to the test material, Test No. II, Appendix, will indicate that this test, too, dealt with relatively simple material. This time the net speed was twenty-two words per minute for there were seven errors. This record indicates that the lesser speeds in typewriting are the result of concentrated attention on each individual stroke, and that words as a whole are not so much the stimulus for the writing of the entire words without reference to the individual letters. There was rapid increase in speed, and there seemed to be little in the fact that the writer had been using a different keyboard to deter the use of the new keyboard. In other words, the writer did not recognize the presence of inhibition in the use of the new keyboard. With curiosity developed as to the effect of this writing on the writing which made use of the standard keyboard, the writer

tried the standard keyboard. It seemed as though there were no decrease in speed nor in general facility of writing. It was simply a matter of deciding to use the first keyboard and then using it. The fingers apparently automatically travelled over the correct paths. This occurred after achieving twenty-nine gross words per minute on the revised keyboard.

After using the standard, the writer somewhat feared the effect on the "Dvorak-Dealey Simplified" keyboard. Determining to use care the following morning, the writer took a one minute test on the simple material of the first test. The result showed a speed of thirty-seven words a minute with one error. The second five minute test followed immediately. This time the net speed was thirty-five words per minute with no errors. Evidently the previous evening's work did not interfere with the morning's test at all, inasmuch as there was a marked increase in speed and there were no errors. The writer, all through the experimental tests, was very much aware of the speed of those typists round about, and this supposedly served as a stimulation to greater speed on her part.

Every day upon entering the class room the students began work on the prepared exercises. These exercises are to be found in the appendix. The class was not kept together, but everyone began where he left off on the previous day. The lesson sheets were not all completed at the beginning of the course. Therefore, if the exercises which were handed out were finished, one simply rewrote those which had already been written. The tests were given the latter half of each period. The writer found, in her particular case, that ordinarily when the exercises were

typewritten rather rapidly even though there were errors, the tests which ensued would be more void of errors. This may have been due to the fact that the need for rigid concentration and control was impressed on the mind, and therefore the tests were more accurate. When the exercises were almost completely accurate, very often the tests were more erratic. This may have been due to a partial let-down in attention because of previous intense concentration. However, this relationship was not unique in this particular experiment, for the writer had observed it to be true in the initial learning experience.

The errors which were made in the exercises were more frequently errors due to some carry-over from the first keyboard situation than were those found in the tests. The errors were not more abundant than those which occurred when the original learning took place. It apparently was true that the same factors which checked errors in the first learning process could be applied in relearning. Good physical condition, attention, interest, and concentration served to aid the checking of errors. The presence of fatigue, or a lapse in attention permitted error making, but not to a greater extent than was found among students who were learning to typewrite for the first time. All words in which errors occurred were written as many times as would fill two typewritten lines. Usually the words in which errors occurred were very simple words.

The next time a test was given, the speed again jumped considerably. On July 7 a one minute test had resulted in thirty-seven words with one error. On July 11 the next one minute test showed a speed of forty-eight words a minute with

one error, nine words more. The five minute test which was given that day showed an increase of four gross words per minute over the last one, the speed being thirty-nine words with five errors, therefore a net of twenty-nine words a minute.

The next day, however, there was a decrease in speed over the previous day. This was partly due to a change in the speed test material. This time the speed in the one minute test was forty-two words per minute with two errors. The net speed in the five minute test was greater than that of the previous day, but the gross speed decreased. The gross was thirty-four words per minute with one error, making the net thirty-two. It seemed as though the two errors in the one minute test were a challenge for cutting down the errors in the five minute test.

On the thirteenth of July, the one minute test was taken as usual, but the gain in speed over the previous day was twelve words, the rating being fifty-four words with no errors. It happened that on this particular day the writer was feeling very good. A good rest the night before may have been partly responsible. Concentration was not difficult to maintain and added stimulus to success was felt due to the fact that while this test was in progress, the writer was under the surveillance of one of the university instructors whom she happened to know. The conversation which ensued between this instructor and the typewriting instructor was regarding the new keyboard, the facility of using it, and the writer's progress. The stimulation received in the one minute test held over for the five minute test, for the writer, again conscious of watching eyes, surpassed all past records in it also, the gross speed being

forty-seven words a minute, the net forty-three, and two errors.

The following day the one minute test speed again improved, this time only one point. The speed was fifty-six words. However, it should be remembered that these one minute tests were covering very simple material, the letters of which were those most frequently used. The material in these tests was not new. In the five minute test for this day there was a marked decrease in speed. The gross speed was forty-one words, net, thirty-three, and four errors. This decrease must have been due largely to more difficult typewriting material on this particular day, for practically everyone in the class, beginners included, experienced a decrease in speed.

On July 15 there was, for no apparent reason, a decrease in speed in the one minute test. The rate was forty-seven words with no errors. However, the decrease in the one minute test did not seem to affect that of the five minute test, for in it the highest speed yet achieved for a period of five minutes was made. The gross speed was fifty-two words; the net was forty-two; and there were five errors.

Monday of the next week found the speed in the one minute test the same as it had been the last Thursday. The five minute test speed was a decrease over Friday, for the gross speed was six words less, being forty-six words per minute. Since there were four errors, the net was only thirty-eight. Upon the conclusion of this test the writer was twitted somewhat by the instructor on the number of errors made in the last few tests. This apparently affected the record of the next day.

On Tuesday the speed in the one minute test rose one

point. It was fifty-six words with no errors. The five minute test record indicated that the accuracy prevailing in the one minute test held over, although the speed in this test was not as great as that for previous tests. The speed was forty-two words per minute with no errors. The writer had purposely gone slowly in this test in order to eliminate errors.

However, the effect of the slower speed in the last test was not desirable, hence an effort was made to secure more speed in the one minute test which followed on the next day. The attempt at speed brought results, for sixty-two words a minute were written, but there were three errors. It was necessary, therefore, in the five minute test to cut down on these errors, and this was very satisfactorily done. The highest record yet established by the writer was produced. The gross speed was fifty-seven words a minute, the one error made bringing the net down to fifty-five words a minute. This great increase was not due solely to an attempt to increase speed, for many others did much better on this test than usual. This would tend to indicate that the material was easier than the average material.

The next one minute test which was taken showed a further increase in speed, this day's speed being five words more than that of the last one minute test. Sixty-seven words a minute with one error was the rating. However, the five minute test speed was such that it might better have followed the test of two days before. That is, the speed which was made in the test of the previous day was much greater than could be maintained at this stage, for in this test there were forty-eight gross words as compared with the fifty-seven words of Wednesday. The

net words were much less, also, because of the presence of five errors, the net being thirty-eight words per minute.

It was at the end of the fourth week that the test material was so markedly changed. Mimeographed tests had been given heretofore, and tests with relatively simple material, but now printed tests were introduced, and the ratings on these immediately decreased quite decidedly. The one minute test was based on the mimeographed material and therefore showed an increase in speed, the speed being seventy-one words per minute with two errors. The gross speed in the five minute test was forty-one words per minute. The added difficulty of the material of this test required greater concentration, hence the errors were partially checked, there being only one error. With but one error, the net speed was better by one point than that of the last five minute test. It was thirty-nine words per minute.

The one minute test which was given on the second day of the fifth week was written perfectly, but the speed of the day before was not maintained, the rate being sixty-nine words per minute. The five minute test was written very accurately but the gross was again less than it had been the day before. The gross and net were thirty-nine words per minute. Thus the net was the same as it had been on Monday. On this day, a ten minute test was given on the speed material which had been used the day before. The results of this test showed a gross of forty-two words, but the seven errors cut the net down to thirty-five. It would be the ten minute tests which might be comparable with the tests which were taken before this experiment began, for they are of longer duration. However, with the stress on the

five minute tests, there seemed to be more errors in the ten minute tests than in those of five minute duration.

Wednesday brought the highest one minute test record yet realized, seventy-two words with no errors--three words higher than Tuesday's record. The accuracy of the one minute test did not hold through the five minute test, though, and in this test there were forty gross words, thirty-two net, and four errors,--the lowest net since the third week. The ten minute test which was given immediately after the five minute test demonstrated the possibility of increased difficulty in that test, for other relearners also had lower speeds in it. A gross of thirty-five, a net of thirty, and five errors were obtained in the ten minute test.

Practice on the universal keyboard on Wednesday evening seemed to assist the speed acquisition on the revised keyboard as evidenced by the speed for Thursday. Thursday's one minute speed test record yielded the highest speed performance accomplished in the whole learning period of the experiment,--seventy-nine words with no errors. The five and ten minute tests for Thursday also indicated greater speed performance. In the five minute test the gross speed was fifty-three words, the net forty-five, and there were four errors. This speed was not yet as great as that which obtained on the mimeographed test material, but it showed a rise, temporary though it was. The ten minute test results showed a decrease in errors, as compared with the other two tests of this duration. There were forty-six gross words, forty-four net, and only two errors.

Friday's record in the one minute test was not as good as Thursday's, since there were two errors, and seventy-five words per minute was the speed. The five minute test, also, was not as good as that of the previous day as far as gross words were concerned, but the net was the same, and there were three errors instead of four. The gross speed was fifty-one words per minute. In the ten minute test, the gross was greater for Friday-- forty-eight words per minute, but four errors cut the net down to forty-four which was the same as Thursday's net speed.

The first week of August, the sixth week in which tests were given, was no better than the fourth week in testing. This shows the extent to which speed was delayed by introducing printed copy material during the fifth week. There was a great change in the speed in the one minute test during this week because mimeographed material was no longer used. Therefore, from seventy-five words per minute, the decrease made this speed only forty-seven words per minute with one error. After this there was not quite so great a difference between the speed in the one minute tests and that in the five minute tests. The Monday speed in the five minute test was a gross of forty-four words per minute, a net of thirty-six, and four errors. It will be observed that this is not as good as the last two days of the previous week. The gross speed in the ten minute test was greater on this day, but there were ten errors, hence the gross of fifty was cut down to a net of forty words per minute.

On Tuesday the one minute test was three words better than Monday's test, the speed being fifty words per minute with one error. However, the five minute results were inferior to those

of the first day of the week. The gross speed was only forty-two words per minute, the net thirty-four, and there were four errors. Again the gross speed in the ten minute test improved, this time by two more words per minute. The gross speed was fifty-two words per minute, the net forty-four, and there were eight errors in this test.

The one minute test for Wednesday was quite an improvement over that of Tuesday, there being no errors and fifty-nine words per minute. However, the five minute test was only slightly better than that of Tuesday. In this test the gross speed was the same as that of Tuesday, forty-two words per minute, but the net was four words better because there were only two errors as compared with Tuesday's four. There was no ten minute test on this day. The last of the one minute tests which were recorded was also completed on Wednesday.

Thursday's test was a very marked improvement over those of the past, sixteen points being gained over the rating of the previous day. The speed in this test brought the writer back to the point where the type of speed material was changed. With the old mimeographed test material, the highest speed attained was fifty-seven. The speed in this test was fifty-eight gross words per minute with two errors which brought the net down to fifty-four words per minute. However, the gross speed in the ten minute test was not as great as that in the last ten minute test. The speed in this test was forty-nine words per minute, the net being forty-one words with eight errors. The great difference between the speed in the five minute test and the speed in the ten minute test can be partly accounted for by the fact

that the speed material in the five minute test may have been easier. It seems that other relearners in the class attained a higher speed on this test also. Then, too, the record of the next day does not hold the higher rate of speed, although it is somewhat higher than the recent tests had been.

On Friday the gross speed was fifty-two words per minute; the net speed was thirty-six words; and there were eight errors. On this day the net speed in the ten minute test was better than that for the five minute period, although there were five errors in the ten minute test. The gross in this test was forty-seven words per minute, and the net was forty-two words per minute.

During the next week, test records were secured for only two days--Wednesday and Thursday. The gross speed on Wednesday in the five minute test was the same as it had been on the previous Friday--fifty-two words per minute. There were less errors though, only two errors; hence, the net speed was forty-eight words per minute. In the ten minute test for that day there were forty-nine gross words per minute, forty-three net words, and six errors. This is very little better than the Thursday record of the past week.

On Thursday there was only a five minute test. The writer maintained splendid accuracy in this test, there being no errors. However, this accuracy was secured at the expense of speed judging by the lowered speed. There were forty-one words per minute.

It was at this point that the writer secured a typewriter with a revised keyboard and used it exclusively. Heretofore, both keyboards had been used. In home work, the writer had

written papers of some length for school work in various classes. These had been written on the universal keyboard. Then, in school practice only the revised keyboard was used. The immediate increase in speed apparently justifies the exclusive use of one machine. In the two remaining weeks, the universal keyboard was not used at all, and the writer got to the point where she could not even think the positions of the keys on that machine without great concentration. Before that it had been very simple to mentally typewrite the alphabet.

On Monday, the first day after this home practice, twenty-four words per minute were gained over the last five minute test. The gross speed was sixty-five words per minute. However, the net was only fifty-three words because there were six errors. The ten minute test on that day also indicated a great increase in speed, for the gross in that test was fifty-four words per minute, the net forty-eight words per minute, and there were six errors.

The speed on Tuesday was not quite as good as that of Monday, but it was better than the speed which had been acquired before the use of the revised keyboard at home. There were fifty-nine gross words per minute, fifty-three net, and three errors. This showed an improvement in that errors were decreased by three, thus permitting the net speeds to be the same. There were two five minute tests on Tuesday, and in the second errors were cut down by one, but the gross speed increased eight words per minute over the first test, being sixty-seven words per minute. The net was sixty-three. This was the highest speed which the writer attained in class tests during

this experiment. It was reached twice, both times in five minute tests. It will be recalled that sixty-three words per minute was the rating on the test on the universal keyboard before the beginning of this experiment, but that test was of fifteen minute duration, whereas this one was for five minutes.

On Wednesday, there were five errors in the test, consequently the net speed was cut down greatly. The gross was sixty-six words per minute, and the net was fifty-six words. This was slightly less than that of Tuesday.

Thursday's record was an even greater decline. Although there was only one error in the five minute test, the gross was only fifty-five words per minute, thus bringing the net down to fifty-three words per minute. This was a decrease of eleven words per minute over Wednesday's record. However, in a ten minute test which was given immediately afterward the gross speed was sixty-two words per minute, the net fifty-four, and there were eight errors. In this test, therefore, the gross and net speeds were superior.

The test on the last day of that week was the one in which the highest speed was again achieved. The five minute test speed was sixty-seven gross words per minute, sixty-three net, with two errors. The ten minute test on this day was better, also, than that of Thursday, for the gross speed was one word per minute greater, being sixty-three words per minute; the net was also one greater, being fifty-five words per minute; and there were again eight errors.

On the last week of the experiment there were only three days of practice and testing. None of the speeds of this week


were superior, the week average being sixty-one words per minute. On Monday, the gross speed was sixty words per minute, the net fifty-five words per minute, and there were five errors. On Tuesday and Wednesday, the errors were held down to one in both five minute tests. Tuesday's gross was fifty-nine words per minute with a net of fifty-seven words per minute. Wednesday's gross was the best for the week, being sixty-four words per minute, with a net of sixty-two words per minute.

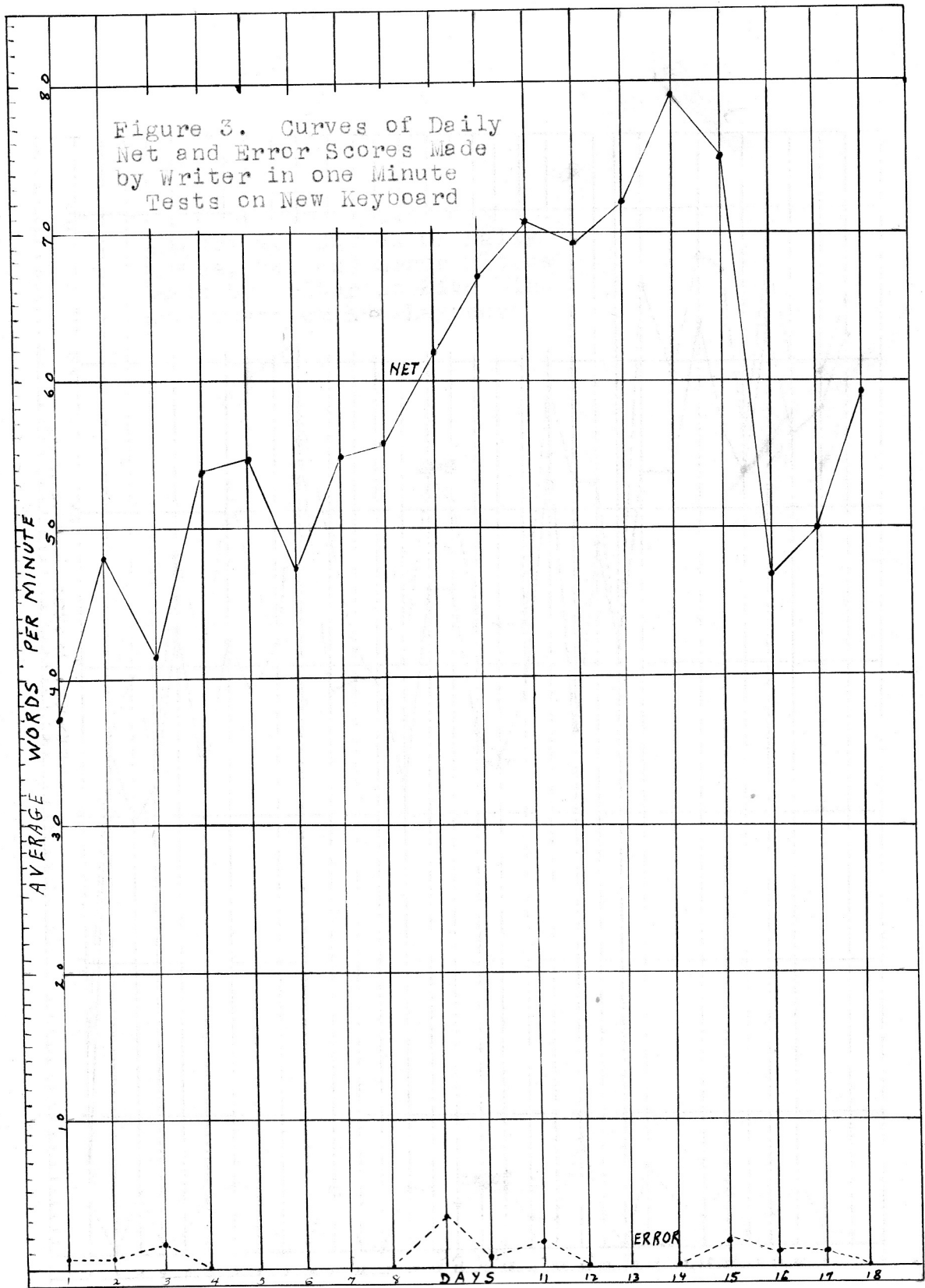
This experiment as a whole demonstrated that if there were practice on the universal keyboard the evening before a test was given on the revised keyboard, that test would be better as far as speed was concerned. However, when attention was directed solely to one machine, the speed immediately increased very perceptibly.

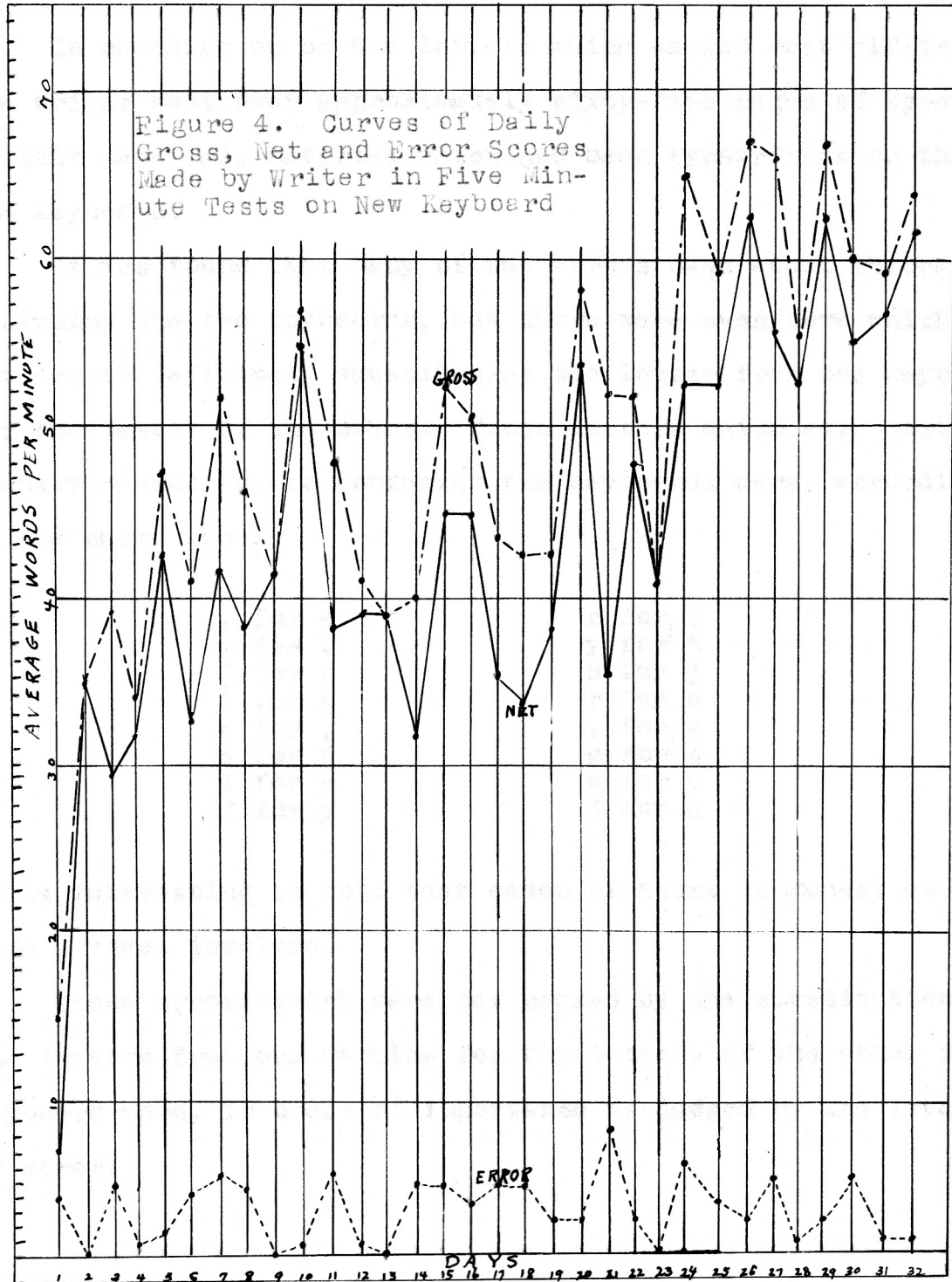
After the experiment was conducted, the writer was given the task of teaching a class in typewriting using the universal keyboard. She took a test of one minute duration on this keyboard and found that she made only fifteen words per minute with three errors, the errors all based on the confusion and substitution of letters from the revised keyboard. There had been about three weeks elapsing between the end of the experiment and the beginning of the teaching project. However, it was very interesting to note the fact that after the preliminary work in teaching the keyboard, much of the time of which was spent in dictation, by thinking the positions of the letters, the writer, upon again sitting down to a machine, found that she could write just as well as she could before the experiment was

undertaken. A ten minute test based on high school speed material indicated that her speed was seventy-one net words per minute with five errors. Thus, apparently the old habits were too deeply ingrained to displace them by the few weeks of practice which had taken place during the summer. For a short period of time the writer could easily write mentally using both keyboards. During the year there was no further reference to the revised keyboard.

It was not until the following summer that the writer again tried to work out the revised keyboard in her mind and attempted to write on it again. A series of one minute tests were taken to determine how long it would take to again have control of the revised keyboard. Before taking any of these tests, the writer inspected a diagram of the revised keyboard. As a result of the first test, seventeen words were written with one error. The second of the series yielded forty-one words with three errors. In the third test, forty-six words per minute were written with three errors. The fourth test showed only thirty-eight words with two errors. However, the fifth test yielded fifty-five words per minute with three errors. These tests were taken one after another. They prove quite conclusively that, with very little practice, the writer could again have been writing on the revised keyboard at the highest rate which she had achieved in the past. Also, there is little danger of forgetting how to typewrite on the universal keyboard if it is well learned, even though the other keyboard be used for a long period of time. Figures three and four show the curves for the tests which are discussed in this entire section.







CHAPTER V. AN ERROR ANALYSIS

In checking up on the letters which caused most difficulty, the writer went over approximately sixty-five pages of typewritten material, material which had been typewritten on the new keyboard.

It was found that many of the errors came about through confusing the two keyboards, but there were even more which were not due to definitely substituting the letter from one keyboard for the letter of the other. Those letters which were most frequently missed due to confusing the keyboards were, according to the check made:

. for e	s for :
v for .	y for t
j for c	h for j
i for g	r for o
w for ,	, for w
e for d	o for s
l for p	g for u
f for y	d for h

It is interesting to note that seven of these commonest errors have a vowel involved.

Those errors which were not caused by the substitution of the letters from one machine for the letters of the other machine keyboard were, in order of importance as judged by the frequency of error:

i for o	e for i	u for i
o for i	o for a	g for i
a for o	r for t	s for l
w for c	s for n	i for n
o for u	i for a	t for w
i for u	y for f	l for r
e for o	i for s	g for h

In this case, it will be observed that thirteen of these twenty-one most common errors are substitutions in which there is a vowel involved. No doubt this tendency to err where vowels are concerned is largely due to the fact that the new keyboard arrangement has been most radically changed insofar as the vowel arrangement is concerned. Then, too, vowels occur so frequently that it is little wonder that they are responsible for a large number of errors.

The writer finds that in her writing many errors are due to the fact that she thinks faster than she writes and then the tendency is to omit letters. This is a faulty habit in writing and occurs on either keyboard. However, it may be partially responsible for the errors which are not due to a definite substitution of the letters from one machine to the other.

As compared with the errors which were made by the beginners in typewriting, the number of errors made by the writer was not greatly in excess of the number made by that group. Perhaps this would be a good standard of comparison if the number of errors were in some way weighted to take into consideration the amount of material written. Miss Goehring, in her report, states that during the ninth week the average errors for the junior high school students was 3.37, for the senior high school students 2.66, for the adults 2.00, and for the relearners

3.66. This larger number for the relearners is partly due to the fact that a great deal more material was written by them.

If there is concentrated attention, relearning typewriting is a very simple thing, and errors are made to about the same extent as they are found in typewriting only on one keyboard. This same attention is absolutely requisite if one plans to write using both keyboards.

The five subjects to transfer their control from the old to the new keyboard. Their ages ranged from nineteen to twenty-six with a twenty-three year average. The attendance of this group was better than other groups. The average age was 23.3 days. All the relearners were given a test on the regular keyboard before starting on the new. The average results of these tests for the five relearners were 10.2 correct, 10.2 errors, 2.4 errors. These figures show that in the new case 100% of the relearners show a gain in speed on the old keyboard as they moved their fingers to the new, and after practicing only nine days. This could indicate the ease of transferring from the old to the new.

The relearners' average words per minute on the new keyboard ranged from 10.20 the first week to 10.20 the ninth week. The new average was from 10.20 the first week to 10.20 the ninth week. The question, "What about all these people who have learned to type on the old keyboard?" is answered most satisfactorily by the results of tests taken by these five relearners. The criteria seems to be the new keyboard, and the new change from one type to the other with little

CHAPTER VI. COMPARISON WITH RESULTS OF OTHER RELEARNERS

Miss Viola Goehring, the instructor of the class in type-writing, in making a report of the various groups with which she dealt, writes as follows: "The relearner group was very interesting. It took no more than one week in any case for the five students to transfer their control from the old to the new keyboard. Their ages ranged from nineteen to twenty-six with a twenty-three year average. The attendance of this group was better than others, an average of 39.8 days. All the relearners were given a test on the regular keyboard before starting on the new. The average results of these tests for the five relearners were 55.2 Gross; 48.4 Net; 3.4 errors. These figures show that not in one case did any of the relearners show as good a record on the old keyboard as they showed after transferring to the new, and after practicing only nine weeks. This would indicate the ease of transferring from the old to the new.

"The relearners' Average Gross words per minute on the new keyboard ranged from 20.40 the first week to 66.66 the ninth week. The Net average ran from 16.20 the first week to 59.22 the ninth week. The question, 'What about all these people who have learned to type on the old keyboard?' is answered most satisfactorily by the results of tests taken by these five relearners. The writer learned to use the new keyboard, and can now change from one type to the other with but little

practice on each. The speed attainable on the new keyboard seems much greater than on the old.

"It will be noted....the relearners enjoyed a constant and fast rise in Gross and Net words per minute until the fifth week. They then dropped just as did the other groups in this same week. This almost proves conclusively that it was due to the change from the typed to the printed material. These relearners were kept on the same material the first four weeks as the other groups. After the fifth week they kept right on climbing upward to an average Gross and Net which exceeded their average Gross and Net on the 'universal' keyboard by eleven Gross and eleven Net words per minute.

"The following figures have been made available on the teaching of typewriting on the OLD KEYBOARD. The usual High School requirement for which a passing grade is given for ninety days' work is eighteen net words per minute, while the average High School attainment for ninety days is twenty-five net words per minute. The usual High School requirement for which a passing grade is given for 180 days' work is thirty net words per minute while the average High School attainment for 180 days is thirty-five net words per minute. It is a very unusual High School attainment when a student makes forty net words per minute in 180 days' work. The State Championship record for 1932 for 180 days' work was fifty-eight net words per minute, and that for 360 days' work was seventy-two net words per minute." (29)

29. Viola Goehring. A Comparison of the Typewriting Achievements of Students Trained on the "Universal" and the "Dvorak-Dealey Simplified" Typewriter Keyboards, Master's Thesis No. 2584, University of Washington, 1933, pp. 49-52

The writer was one of these five relearners. As computed, the average attainment for the ninth week showed a gross of 66.6 words per minute, a net of 59.33, and 3.66 errors. This would indicate that the average net words per minute per hour of practice was 1.49. However, again it must be borne in mind that this test was one of five minute duration, also, that in most cases more time was devoted than only one hour a day. Then, too, this group worked solely for speed, and did not take time for considerations of form, etc., which would be absolutely necessary in a high school course. Relearners would have had that background necessary for form from their work on the other keyboard.

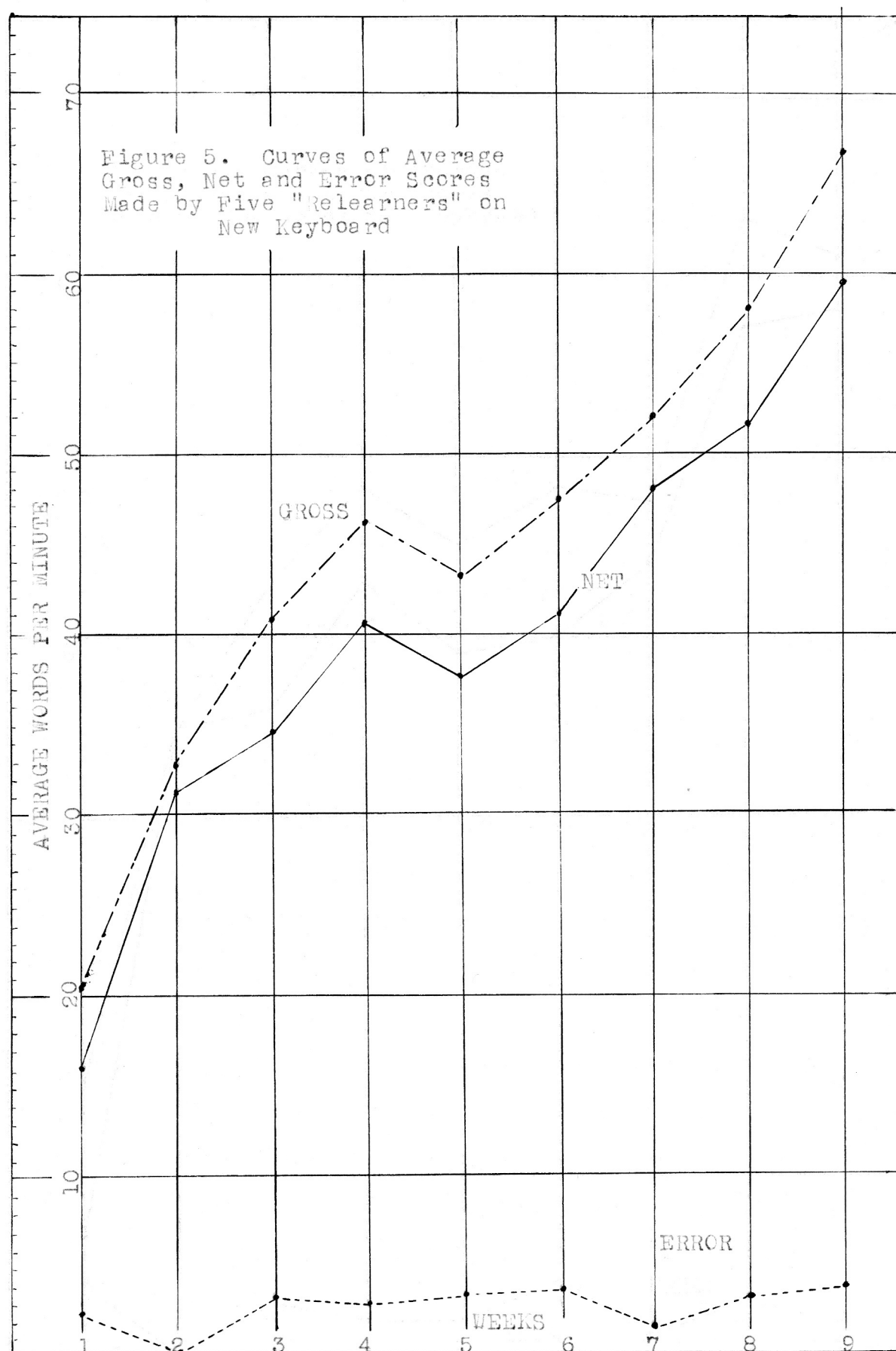
A table follows which shows the averages for the gross net and error scores made by the five relearners for each week for nine weeks. These averages started on the first of July. Some had had preliminary practice and some had not. The writer is number four in the group. This table was prepared by Miss Goehring in her report.

TABLE I

AVERAGE GROSS, NET AND ERROR SCORES MADE BY FIVE
RELEARNERS FOR EACH WEEK FOR NINE WEEKS

Weeks	1	2	3	4	5	6	7	8	9
Students	1	2	3	4	5	6	7	8	9
Gross	12	18	20	20	25	30	41	44	60
Net	6	14	24	25	21	28	41	35	52
Errors	3	3	1	5	4	1	0	4	4
Gross	20	30	42	49	39	50	52	58	60
Net	20	28	40	45	31	42	48	54	52
Errors	0	1	1	2	4	4	2	2	2
Gross	25	35	42	57	51	50	48	64	67
Net	34	35	51	55	45	50	54	57	73
Errors	3	1	4	5	6	4	2	1	5
Averages	20.40	33.00	41.00	46.20	43.40	47.80	52.20	58.25	66.66
	16.20	31.40	34.60	40.80	37.80	41.20	48.20	52.00	59.33
	2.40	.0	3.20	2.80	3.20	3.40	2.00	3.00	3.66

* Writer's record.



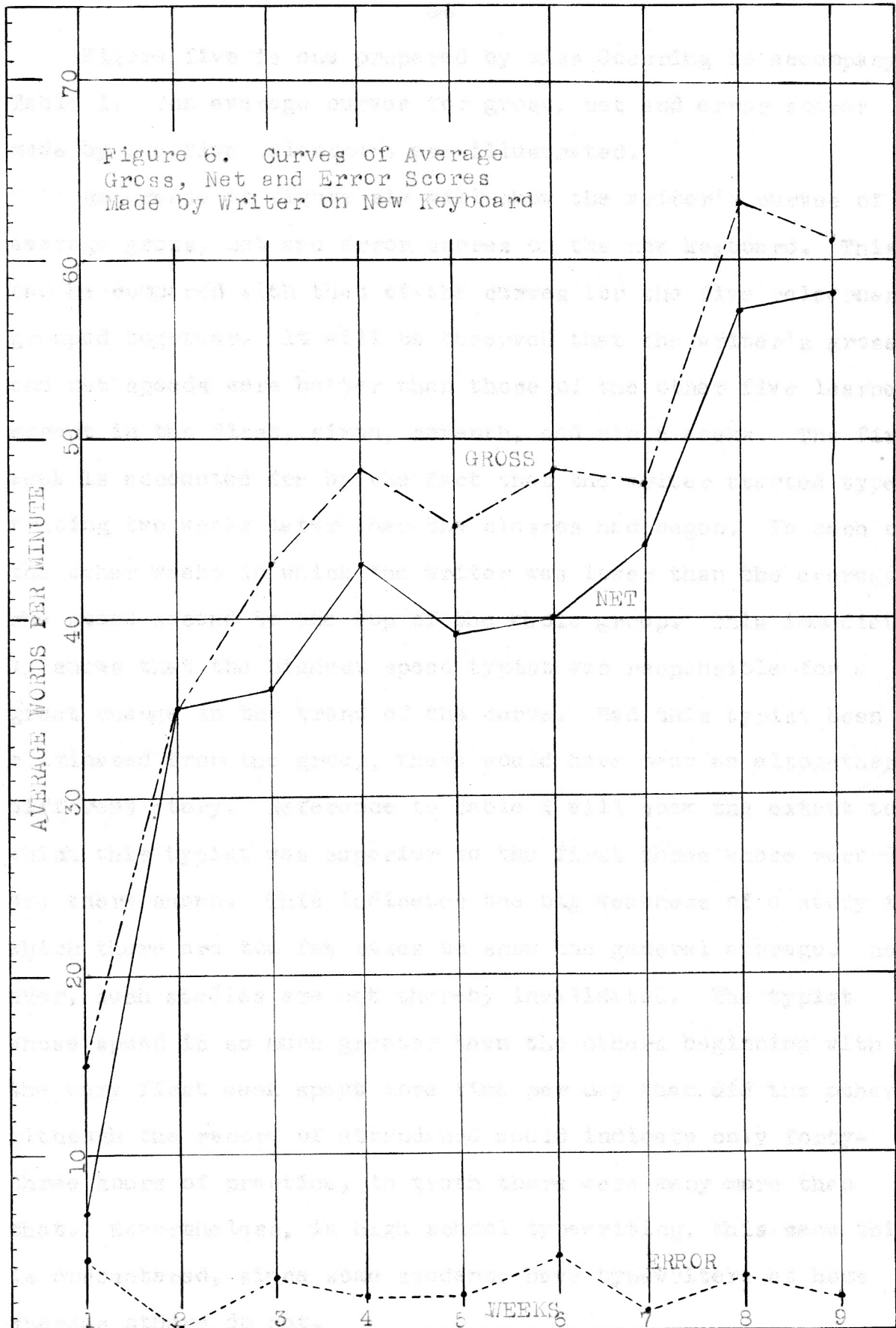


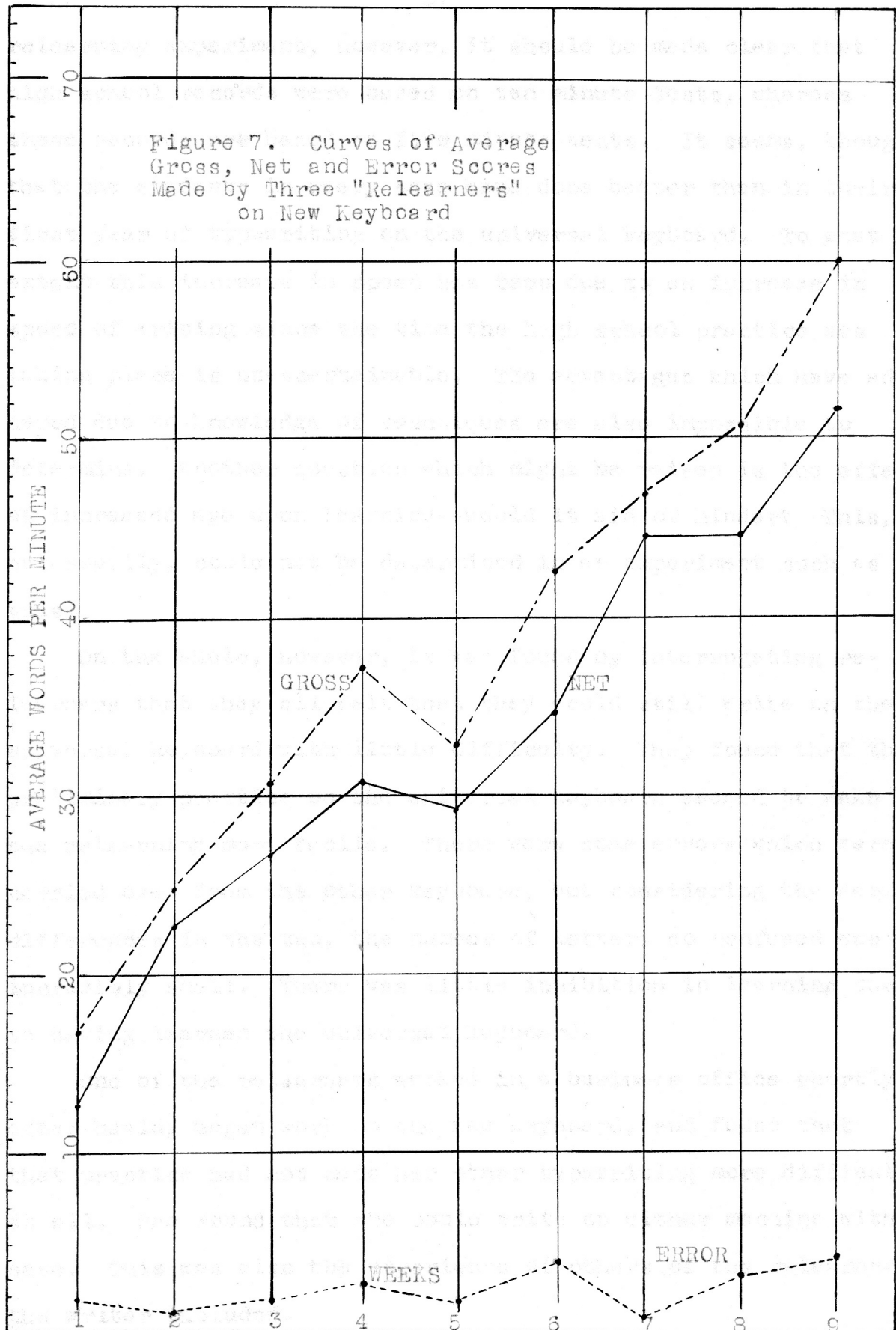
Figure five is one prepared by Miss Goehring to accompany Table I. The average curves for gross, net and error scores made by the five relearners are illustrated.

Reference to figure six will show the writer's curves of average gross, net and error scores on the new keyboard. This can be compared with that of the curves for the five relearners grouped together. It will be observed that the writer's gross and net speeds were better than those of the other five learners except in the first, sixth, seventh, and ninth weeks. The first week is accounted for by the fact that the writer started typewriting two weeks later than the classes had begun. In each of the other weeks in which the writer was lower than the average, she stood second to the top of the whole group. This immediately shows that the highest speed typist was responsible for a great change in the trend of the curve. Had this typist been eliminated from the group, there would have been an altogether different story. Reference to Table I will show the extent to which this typist was superior to the first three whose records are there shown. This indicates the big weakness of a study in which there are too few cases to show the general average. However, such studies are not thereby invalidated. The typist whose speed is so much greater than the others beginning with the very first week spent more time per day than did the others. Although the record of attendance would indicate only forty-three hours of practice, in truth there were many more than that. Nevertheless, in high school typewriting, this same thing is encountered, since some students have typewriters at home whereas others do not.

Figure seven follows in which the last typist's record has been eliminated, as well as that of the writer. Note the difference between this figure and the original. Then compare it with figure six, the writer's curve.

Reference to figure seven shows that the writer surpassed the other three relearners in all but the first and the seventh weeks. However, the writer put in more time than the thirty-eight hours which the attendance record would suggest, also. The trend of the curves when the writer and the high curve student have been eliminated is just the same as the original curve for the five relearners was. Hence, for practical purposes it would appear that there was an almost steady increase in speed throughout the learning process, the one big decrease having been due to the decided change in the difficulty of copy material, printed material having taken the place of the prepared mimeograph sheets. This change occurred during the fifth week, but a steady increase in speed follows the depression.

At the end of a year's work, that is, after the original learning of the universal keyboard, Student No. 1 in Table One was making on the average twenty-eight words per minute. Student No. 2 was making an average of 45 words per minute. The writer was unable to determine the average of Student No. 3, but the writer, Student No. 4, was averaging forty-nine words per minute. These three typists had had only one year of typewriting in high school. Student No. 5 had had two years of high school training and was making around sixty words per minute. Before comparing these results with the speed made in the



relearning experiment, however, it should be made clear that high school records were based on ten minute tests, whereas these records are based on five minute tests. It seems, though, that the students in every case have done better than in their first year of typewriting on the universal keyboard. To what extent this increase in speed has been due to an increase in speed of writing since the time the high school practice was taking place is unascertainable. The advantages which have adhered due to knowledge of techniques are also impossible to determine. Another question which might be raised is the effect of increased age upon learning--would it aid or hinder? This, necessarily, could not be determined in an experiment such as this.

On the whole, however, it was found by interrogating re-learners that they all felt that they could still write on the universal keyboard with little difficulty. They found that their preliminary practice on the universal keyboard seemed to make the relearning more facile. There were some errors which were carried over from the other keyboard, but considering the marked differences in the two, the number of letters so confused was incredibly small. There was little inhibition in learning due to having learned the universal keyboard.

One of the relearners worked in a business office shortly after having begun work on the new keyboard, and found that that practice had not made her other typewriting more difficult at all. She found that she could write on either machine with ease. This was also the experience of others of the relearners, the writer included.

Whereas the five relearners' averages show that on the average, 1.49 net words per minute per hour of practice were gained, the writer's gain per hour of practice as judged by the average attainment for the ninth week of practice was 1.53. Again such an average does not take into consideration the fact that there may be time spent outside of class. Hence, it is not altogether valid.

CHAPTER VII. SUMMARY AND CONCLUSIONS

From the findings of this experiment the following summary is prepared:

1. Learning a different keyboard may be very successfully accomplished after having typewritten on one keyboard for several years.
2. This relearning will be acquired more rapidly than was the original learning of the keyboard because of certain similarities, such as the carriage return, shift of keys, stroke, etc., which would already be learned in connection with the first learning of the keyboard. Then, too, the revised keyboard was found very simple to learn.
3. A person may successfully operate both keyboards, alternating from one to the other with little difficulty. However, a greater degree of attention and concentration are requisite if a person plans to use both keyboards.
4. A person can achieve as great and greater speed with the "Dvorak-Dealey Simplified" keyboard as he originally possessed on the "universal" keyboard in a relatively short period of time.
5. Errors made in work on the new keyboard are not in excess of the number of errors made in practice work when one first learns to typewrite.
6. Interest and attention help considerably in an experiment of relearning such as this.

7. The element of fatigue seems responsible for a large number of errors, although intense concentration can, in large measure, combat fatigue. Retroactive inhibition in relearning on a new keyboard occurs most often under conditions of fatigue and inattention.

8. Several of the errors made in practice work on the revised keyboard were due to a temporary let-up in attention such that the fingers automatically found the old position of the letters. However, this did not happen as often as might be expected.

9. In the early stages of relearning, practice on the universal keyboard the evening before morning practice on the revised keyboard served to stimulate speed on the revised keyboard, although there tended to be more errors.

10. When only the revised keyboard was used and the universal keyboard was temporarily forgotten, there was a slight increase in speed.

11. When a return was made to the universal keyboard, it was found that a sheer act of will would not bring back the former skill, but the exercise of the muscles themselves tended to re-establish the chain of subconscious reflexes, in such a way that it took only a day or two to again secure the average speed and accuracy which had obtained before the experiment was begun.

12. In writing the first few words when trying to return to the universal keyboard after practice only on the revised one, attention had to move, as in the early stages of learning, to the exact position of the letters to be struck before the

fingers could start, and then certain letters, especially at the ends of words, came almost spontaneously, although these same letters, at the beginning of words, were sources of perplexity in endeavoring to locate them.

13. Many of the introspective processes in relearning on a new keyboard are much like the processes involved in the original learning, but there are fewer waste movements and thoughts.

14. After a year of again using only the universal keyboard, it was found that an attempt to use the revised keyboard was much the same as the return to the universal had been. After a study of the revised keyboard, the return was gradual until the actual pre-location fused with the motor-tactual feel of the movements. The sight of a letter then called forth at once a movement of attention in the proper direction just before the required movement.

Such a study as this is weak in that there are not enough cases presented upon which to establish scientific facts. However, this does not mean that the study is invalidated. If many more such studies were made, one might better generalize from the findings. The results in the writer's experiment show the same general conclusions as might be drawn from studying the records of the other four relearners who are mentioned.

There is quite a field for further investigation in the problem of relearning. The results of a long-time use of both keyboards would be interesting. A more definite study of errors and their analysis in connection with relearning would be worthy of experimental treatment.

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APPENDIX ONE: LESSONS

LESSON ONE

Margin stops 10 and 70. Do not look at keyboard. Keep eyes on copy beside machines. Concentrate on rhythm by writing smoothly and evenly.

;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az
;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az ;az

ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/
ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/ ls/

,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq
,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq ,oq

LESSON TWO

an or on ar ll as no al av so oo ro ls rs lo ss os sa ol
rn ns n/ rr nl nn ls na rl oz qa za va va ls sl sr rn za

ro za rn sr sl sa va za qa oz rl na ls nn nl rr n/ ns rn
ov ol sa os ss lc rs ls ro co so av al no as ll er on or

ro za rn sr sl sa vs va za qa oz rl na ls nn nl rr n/ ns
ov ol sa os ss lc rs ls ro oo so av al no as ll er on or

LESSON TWO B

an ar as al av az aq ao or ol on os oa oz oq ov za qa qs
an ar as al av az aq ao or ol on os oa oz oq ov za qa qs

ra ro rl rn rs rv rq la lo lr ls ln lv na no nr nl ns n/
ra ro rl rn rs rv rq la lo lr ls ln lv na no nr nl ns n/

ar ro ol os sa al lr rn na as so on ns sl lo oz za aq qo
ar ro ol os sa al lr rn na as so on ns sl lo oz za aq qo

or re an nl lo on nr rs so ol la as sn na av vo oa al ln
or ra an nl lo on nr rs so ol la as sn na av vo oa al ln

LESSON THREE

Set margins at 10 and 70

Word drill on third and fourth fingers. Please keep eyes on copy along side machine. Concentrate on rhythm.

son none lone lane nose rose sore lore bare an, or; nasal
son none lone lane nose rose sore lore bare an, or; nasal

valor ravel savor arson snarl Larson Lora Nora snore razor
valor ravel savor arson snarl Larson Lora Nora snore razor

LESSON FOUR

an, or; on, ar; ll, as; no, al; av, so; oo, ro; ls, rs;
an, or; on, ar; ll, as; no, al; av, so; oo, ro; ls, rs;

ro; ze, rn; ar, sl; sa, va; ze, qa; oz, rl; na, ls; nn,
ro; ze, rn; ar, sl; sa, va; ze, qa; oz, rl; na, ls; nn,

aeui dhtns aeui dhtns aeui dhtns aeui dhtns aeui dhtns
aeui dhtns aeui dhtns aeui dhtns aeui dhtns aeui dhtns

snthd iueoa snthd iueoa snthd iueoa snthd iueoa snthd iueoa
snthd iueoa snthd iueoa snthd iueoa snthd iueoa snthd iueoa

LESSON FIVE

and the their, and the their; and the their, and the their;
and the their, and the their; and the their, and the their;

add and aid the led; he said adieu, then died; the lad is
add and aid the led; he said adieu, then died; the lad is

the lad had tea in the den, then ran; these sons are true;
the lad had tea in the den, then ran; these sons are true;

he sat; she ran; she sat; he ran; they ran; they run; it is,
he sat; she ran; she sat; he ran; they ran; they run; it is,

LESSON SIX

sit still to do it; stand still and do it; then shut the door
sit still to do it; stand still and do it; then shut the door

the sheet is not there; the tie is too thin; she told her to
the sheet is not there; the tie is too thin; she told her to

to dine in the hall; the stunt is too hard; the tie is too
to dine in the hall; the stunt is too hard; the tie is too

LESSON SEVEN

Set margin at 10 and 70

The date is not set. Then that lad sent the letter to her.
 The date is not set. Then that lad sent the letter to her.

He aided the lad in his serious suit to rule at the initiation.
 He aided the lad in his serious suit to rule at the initiation.

It is indeed thin. I dare not do it; it is not set. He dares.
 It is indeed thin. I dare not do it; it is not set. He dares.

He did endure the test. He had one thousand neat ideas. I do.
 He did endure the test. He had one thousand neat ideas. I do.

LESSON EIGHT

The nurse eases the lad's pains. The date is set to hear him.
 The nurse eases the lad's pains. The date is set to hear him.

That lad sent the letter to her. It is indeed not thin. I do.
 That lad sent the letter to her. It is indeed not thin. I do.

That lad did not endure the test. I dared her to do it.
 That lad did not endure the test. I dared her to do it.

He ate the dish of dates. Their son is on a diet. I shall
 He ate the dish of dates. Their son is on a diet. I shall

LESSON NINE

Nine dishes are done. The estate is at hand. The lad is not
 Nine dishes are done. The estate is at hand. The lad is not

To detain is to err. He is not a heathen. He has a hoe.
 To detain is to err. He is not a heathen. He has a hoe.

Hollie has on her hood, not her hat. Did he have it in his
 Hollie has on her hood, not her hat. Did he have it in his

LESSON TEN

Hasten the issue, so it shall arrive there in time to aid the
 Hasten the issue, so it shall arrive there in time to aid the

The nation needs our assistance in the dedication of the statue
 The nation needs our assistance in the dedication of the statue

The dust in the east causes disease in the head. Is that true?
 The dust in the east causes disease in the head. Is that true?

LESSON ELEVEN

I can not do this thing. I shall do it gladly. The girl ran.
 I can not do this thing. I shall do it gladly. The girl ran.

The cat ran into the house as the dog chased her through.
 The cat ran into the house as the dog chased her through.

The noise ceased as the teacher called the roll early in the day.
 The noise ceased as the teacher called the roll early in the day.

LESSON TWELVE

The calf and the cat fooled around the yard the livelong day.
 The calf and the cat fooled around the yard the livelong day.

The cat ate the goldfish and then ran out of the house in haste.
 The cat ate the goldfish and then ran out of the house in haste.

He caught the dog around the leg as he tried to leave the yard.
 He caught the dog around the leg as he tried to leave the yard.

She found her ring outside of her ring container as she left.
 She found her ring outside of her ring container as she left.

LESSON THIRTEEN

The cow was not large enough to sell so the owner had to wait.
 The cow was not large enough to sell so the owner had to wait.

The waste was too great for the old fellow to stand so he left.
 The waste was too great for the old fellow to stand so he left.

Her wages were not sufficient so she went out to secure more.
 Her wages were not sufficient so she went out to secure more.

Are you going to the show with us tonight? I should say not.
 Are you going to the show with us tonight? I should say not.

LESSON FOURTEEN

The man gave a speech but we did not hear him, for we were late.
 The man gave a speech but we did not hear him, for we were late.

By the way, are you going to our show in the house by the lake?
 By the way, are you going to our show in the house by the lake?

Bill will soon be here, providing he can get his pay from the bank.
 Bill will soon be here, providing he can get his pay from the bank.

LESSON FIFTEEN

The bear went over the mountain to see what he could see, and the other side of the mountain was all that he could see.

Dear Sir: We are in receipt of your letter of yesterday's date and wish to inform you that we are out of the goods for which you asked. Thank you very much for your inquiry.

Yours truly.

LESSON SIXTEEN

The strawberry jam is now good to eat. Please give it to our little children. They will enjoy it very much, I know.

The aged uncle had a young niece who had blonde hair. But the blonde hair was not a natural color. It was dyed.

However the aged uncle knew nothing regarding this hair.

LESSON SEVENTEEN

Dear Jack: This is a bright day in July and we are having a nice time at school. We are taking typing and progressing very rapidly. Soon I shall be able to write at a good rate of speed. I am trying to win one of the gold prizes which are being offered for accomplishment. If I keep on at the good rate at which I am now going I shall be able to write and tell you just what I won. I shall close now. Good night.

LESSON EIGHTEEN

May we hear from you? The day is long. It is too bad.

They went together; neither went alone. It was nice of you.

We have no more of that goods. Please answer soon. We are.

May we hear from your firm soon? We await your reply.

Your immediate reply will be appreciated very much by us.

LESSON NINETEEN

She may go yet. She may see her boy. She may let him try the big car. He did ask for the job. Can she say he has to do it? It is bad for him to go his own way, now. Yes, she may say he can ask the man for two. Can he pay for the car on the 1st, too? How far can it go?

She has a car of her own. She is on her way to see him. He may ask her to go to see the lot. He may ask her if she can pay for the lot, now. Her way to pay may not be his way. She may ask her boy to pay for the lot. She may pay for the car for her boy so he can pay for the lot.

May I ask him to let my boy pay for the lot? He has a job and can pay for it, now. He can pay his own way and pay for the lot, too. The man may let me pay for the lot, now. My boy can pay me in a day or two. I may ask my boy to let me pay for his lot so he can pay for his car. If he has a car he can go to his job in it. He can pay for a car and a lot. I can pay now, and he can pay me.

Alphabetic Sentences

The bank recognizes the claim as valid and quite just, and we expect a full payment.

A large number of our citizens have signed a petition which makes request for a more just system of taxation.

LESSON TWENTY

Accuracy Drill "i" and "e"

Marie had been teaching in a business college for eight years. She was a sincere friend of all her pupils and they had complete confidence in her splendid judgment. She gave them fine ideals of life and service which will be of benefit to them in their business careers.

Accuracy Drill "a" and "o"

There is an added advantage in opening an account here. Every creditor has the assurance that his savings are receiving interest and yet are subject to immediate call. We endeavor to accommodate patrons above all else. A leaflet is enclosed explaining the service which we are able to render.

Accuracy Drill "d" and "e"

A knowledge of one's defects should make one humble, and a knowledge of one's powers conceited enough to enable one to achieve one's desired ends. One needs to believe in one's self, but not be over-confident nor on the other hand self-depreciative.

Accuracy Drill "s" and "d"

The designs for the doors and windows in the new addition were submitted to the Board of Directors on Wednesday of last week. After considerable discussion over certain details, the Board expressed itself as satisfied and recommended that bids be called for immediately. As soon as a contractor has been selected, construction will go forward with all possible speed.

LESSON TWENTY-ONE

Accuracy Drill "t" and "r"

Large retail stores are supported by different departments. Write to them for information and get their reports. Please return the reports after you are through with them. Let us try to attract travelers to this particular trade.

Accuracy Drill "i" and "u"

Various business houses throughout our territory issue instructions covering their discount policy. In our judgment such a procedure is useful because it avoids unpleasant complications and misunderstandings. Beginning January fourth our office will furnish you with printed instructions governing our future business. Kindly consult us if questions arise.

Accuracy Drill "e" and "r"

We tried to get them to use our service in every letter we wrote. They seemed to read our letters, for we received letters in reply, but they never seemed to care to take advantage of the suggested service. Therefore, December 1 was a red-letter day. Their President signed for our service for three years. We are enclosing the per cent of profit due you on the agreement.

APPENDIX TWO. TESTS

The one lad sat on the street and tied the too thin linen	57
to his hat. He said to the other lad that he heard the	112
horn sound, then he ran into shelter. He had stolen the	168
too thin linen and did not have the nerve to sit still.	223
The other lad had not stolen the too thin linen so he sat	280
still and later had tea alone in the den. As he entered	336
the den he shut the door. There he sat until the other	391
lad ran to this one and they entered the hall. These sons	449
are not true.	462

Test 1. First Typing Test Given to Students on July 1, 1932

He died so there is an estate to settle. They all dared her	60
to settle it on that day. He aided her in her serious suit.	120
She said she dare not do it on that day. So she sent a letter	182
to the lad to endure the test one day. That lad did not	238
endure the test as he had one thousand neat ideas on the dare.	300
She sent another letter to the lad. Later he did endure the	359
test and sent her a letter. The letter is indeed not thin.	418
The date is set. The lad had his hat in his hand and aided	477
her out the door. He adheres to the one thousand rules quite	538
a lot. The lad is told that to detain is to err. They then	599
set the date to hasten the issue.	632

Test 2. Second "New Material" Test Given, Results of Which Were Recorded for Second Week

She sent a letter to the lad to tell the lady to enter the	58
hall as it is still not too late to enter. She had heard	115
of the death and the estate that had to be settled. She	171
had to attend. She had her hat in her hand as she entered	229
the hall. The lad tried to attend to and adhere to the one	288
thousand rules as she entered. The estate is not yet	341
settled as the door is not shut. It is still too late in	398
the day to attend to the duties, nearly too late to endure	456
the test. The lady and lad then had tea alone at a late	512
hour. The estate is not settled. As the lad aided her out	571
the door he had his hat in his hand. The day is over. The	630
day is too short. The reason that the estate is not settled	690
is that the sheet is not there in the den. They had lost it.	751

Test 3. Third "New Material" Test Given, Which Was Recorded

As we sat on the porch on a cool summer evening we heard	56
noises. We wondered what it was all about so we began to look	119
around. In the backyard we could see a cat running around	178
with her hair standing on end. She seemed terribly frightened	240
about something. Soon we saw what it was. It was a dog. He	301
was running as hard as he also could run. We tried to help the	364
poor cat so the dog would not hurt her. We ran toward the cat	426
trying to catch her. The harder we ran the faster the dog	484
seemed to go. Our little brother soon caught the dog by his	544
collar and we then tied the dog up in the back yard. The poor	606
cat then came back to us and curled up on my sister's lap.	664

Test 4. Fourth "New Material" Test Given, Results of Which Were Recorded for Fourth Week

We all decided to go to a picture show rather than to go	56
and hear the man give a speech for we were too late to go	113
to the lecture. We left home about seven thirty. Just as	171
we arrived at the door of the show we met Bill. He said	227
that he would go to the show with us providing he could get	286
his pay check cashed. We told him we would let him have	342
some money until he could get to the bank. He seemed very	400
glad and went into the show with us. We saw a picture of	457
a cow and her calf. Since we had been raised on the farm it	517
recalled our childhood days to us. They seemed to fool around	578
all evening. We did not enjoy the show too much. We went	636
home and the next day Bill came over and brought us the	691
money we had let him have the night before.	734

Test 5. Given Students from Fifth Week on for Motivation

The whole world loves a home. Mother likes boys and girls	58
in our home. They are all dear to her. She likes	108
good books in our home, too. She is happy	150
when home is a place of love and rest. Did you ever	202
think that half of your life is spent at home? Value	255
your friends above money and open your home to them	306
at least every few weeks. It will not matter in	354
making them happy whether your home is small or	401
large, if kindly feeling is everywhere present	447
while they are there. They will thank you again and again.	506

Test 6. Given Students from Fifth Week on for Motivation

TYPE OF MATERIAL USED FOR TESTING STUDENTS ON NEW
KEYBOARD DURING THE FIFTH, SIXTH, SEVENTH, EIGHTH
AND NINTH WEEKS OF EXPERIMENTAL COURSE

Other tests given from fifth week on were:

Woodstock Typewriter Test and Practice Matter,
November, 1931

Remington Awards Test, June 1927

L. C. Smith & Corona Typewriter Award Test for
Typing, March, 1930

Royal Awards Test, June 1926, and many others
of this same type.